INSTRUCTION MANUAL

FOR

NOISE AND FIELD INTENSITY METER

MODEL NF-105

EMPIRE DEVICES PRODUCTS CORP.

BAYSIDE 61,
NEW YORK

EMPIRE DEVICES PRODUCTS CORP.
38-15 Bell Boulevard
Bayside 61, New York

ADDENDUM TO NF-105 INSTRUCTION MANUAL ISSUED AFTER JULY 1955.

Recently, there have been some changes in the pick-up devices for the NF-105. The major change concerns the dipole antennas in that balun type dipoles (DM-105) were introduced. In addition, the magnetic field probe was modified so that it may be used without the balanced injection block.

For the sake of clarity, the instruction manual describes the use of the pick-up devices in the above mentioned form only. This addendum is provided to enable users of Dipole Antenna DA-105 or Magnetic Field Probe MP-105 (twinax connector) to properly interpret the instruction manual for their particular accessories.

Dipole Antenna

To use Dipole Antenna DA-105 remove the protective cover from the coaxial connector and attach the balanced injection block. Connect the 30 ft. cable with the green connector to the green BNC receptacle on the block. With this arrangement, one side of the dipole is terminated in the balanced injection block; the other side is fed to the 50 ohm SIGNAL INPUT. As a result, only one half of the signal power developed in the dipole is utilized. For this reason, the output indication is 3 DB less than that of the DM-105 where the signal from both sides of the dipole is used.

The DIPOLE FACTOR chart (page 26) is calculated for the DM-105. Therefore, if measurements are made with the DA-105 it is necessary to add 3 DB to the result derived from this chart.

Magnetic Field Probe

If the magnetic field probe has a twinax connector (in contrast to the BNC connector provided on most magnetic probes) attach the balanced injection block. Then connect the 30 ft. cable with the green connector to the green BNC connector on the block.

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SERIAL NO. 350

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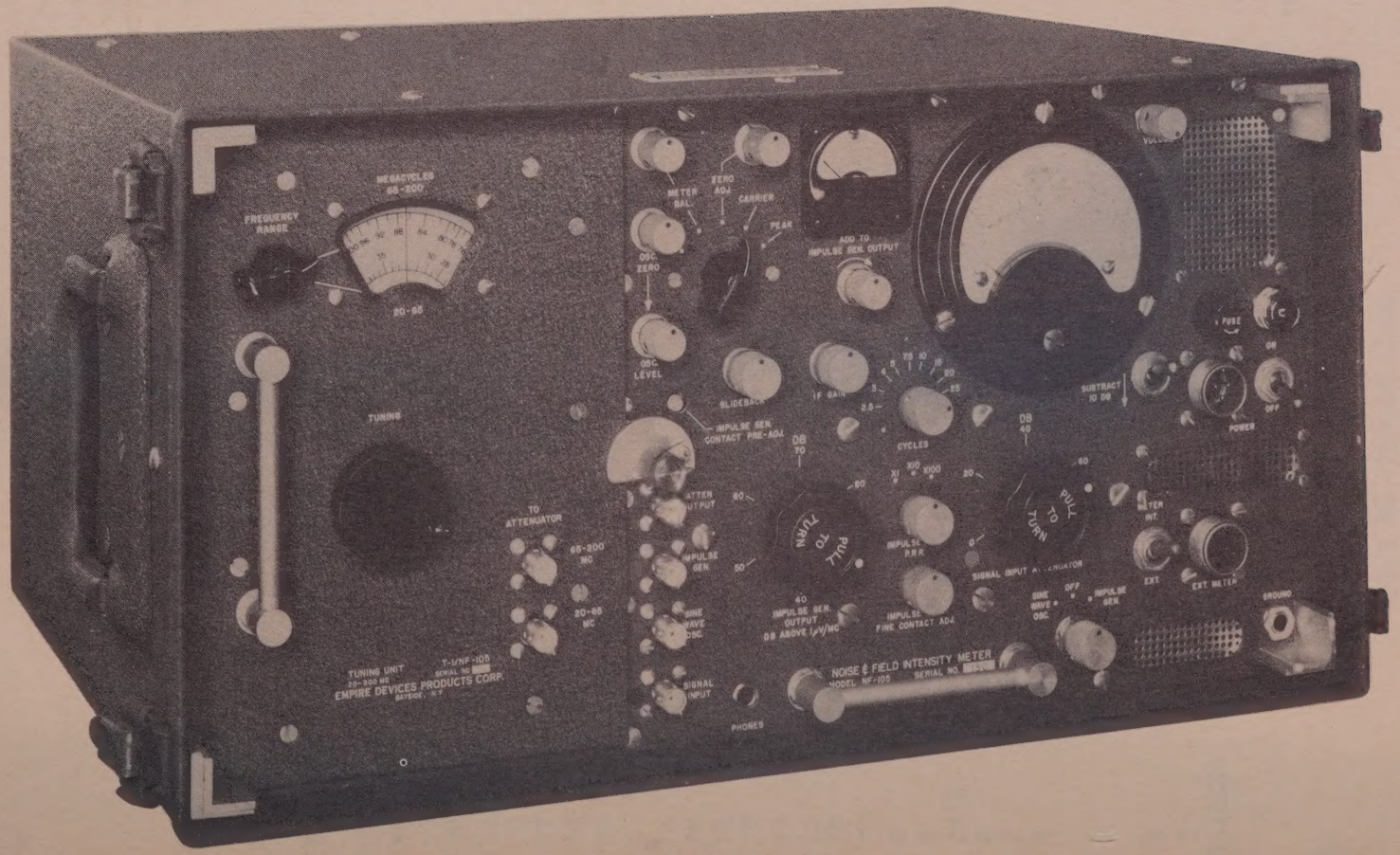

FREQUENCY RANGE
MEGACYCLES 65-200
20-65
METER BAL.
ZERO ADJ.
CARRIER
PEAK
OSC. ZERO
OSC. LEVEL
SLIDEBACK
IMPULSE GEN. CONTACT FINE ADJ.
ADD TO IMPULSE GEN. OUTPUT
IF GAIN
CYCLES
SUBTRACT 10 DB
POWER
OFF
TUNING
TO ATTENUATOR
65-200 MC
20-65 MC
ATTEN OUTPUT
IMPULSE GEN.
SINE WAVE OSC.
SIGNAL INPUT
PHONES
PULL TO TURN
IMPULSE PRR
IMPULSE FINE CONTACT ADJ.
40 IMPULSE GEN. OUTPUT DB ABOVE 1 μV/MC
SIGNAL INPUT ATTENUATOR
METER INT.
EXT.
EXT. METER
GROUND
TUNING UNIT T-1/NF-105
20-200 MC SERIAL NO.
EMPIRE DEVICES PRODUCTS CORP.
BAYSIDE, N.Y.
NOISE & FIELD INTENSITY METER
MODEL NF-105 SERIAL NO.

PART ONE - INTRODUCTION

SECTION I

Description of Noise and Field Intensity Meter Model NF-105

1. General

Noise and Field Intensity Meter Model NF-105 is intended for use in the frequency range from 150 KC to 1000 MC. This frequency range is covered by means of four plug-in heads which house the R. F. and I. F. circuits. The Basic Measuring Unit contains detectors and audio circuits, calibrating standards, attenuators and indicating circuits as well as a voltage regulated power supply. The 150 KC to 20 MC portion of this equipment is treated in a separate book and therefore this book concerns itself with the 20 MC to 1000 MC range. In addition, dipole antennas, magnetic, electric and line probes, injection blocks, cables and carrying cases are available. Inverters for DC operation of the equipment,a broad band antenna set and a remote indicating meter may be had as optional equipment.

2. Application

Model NF-105 provides a compact, lightweight,portable noise and field strength meter for measurements of noise originating in electrical and electronic equipment and of electrical field strength. Built-in impulse noise and sine wave generators are used as calibrating standards for noise and carrier measurements. Readings may be taken using a visual indicator (meter) or aural means (slide-back method). Figure 1 illustrates a typical application of the instrument.

3. Technical Characteristics

POWER REQUIREMENTS: 115 volts, 50 to 400 cycles (100 VA) or 12 or 24 Volts, DC (190 Watts)

VOLTAGE REGULATION: "A" and "B" supply regulated for operation from 105 to 125 volts AC or 11.5 to 15 volts DC (23 to 30 volts DC respectively).

FREQUENCY RANGE: 150 KC to 1000 MC in four plug-in heads. Tuning Unit T-A/NF-105 treated in a separate book, covers the range from 150 KC to 30 MC in six bands; Tuning Unit T-1/NF-105 covers the range from 20 to 200 MC in two bands; Tuning Unit T-2/NF-105 covers the range from 200 to 400 MC in one band; Tuning Unit T-3/NF-105 covers the range from 400 to 1000 MC in two bands.

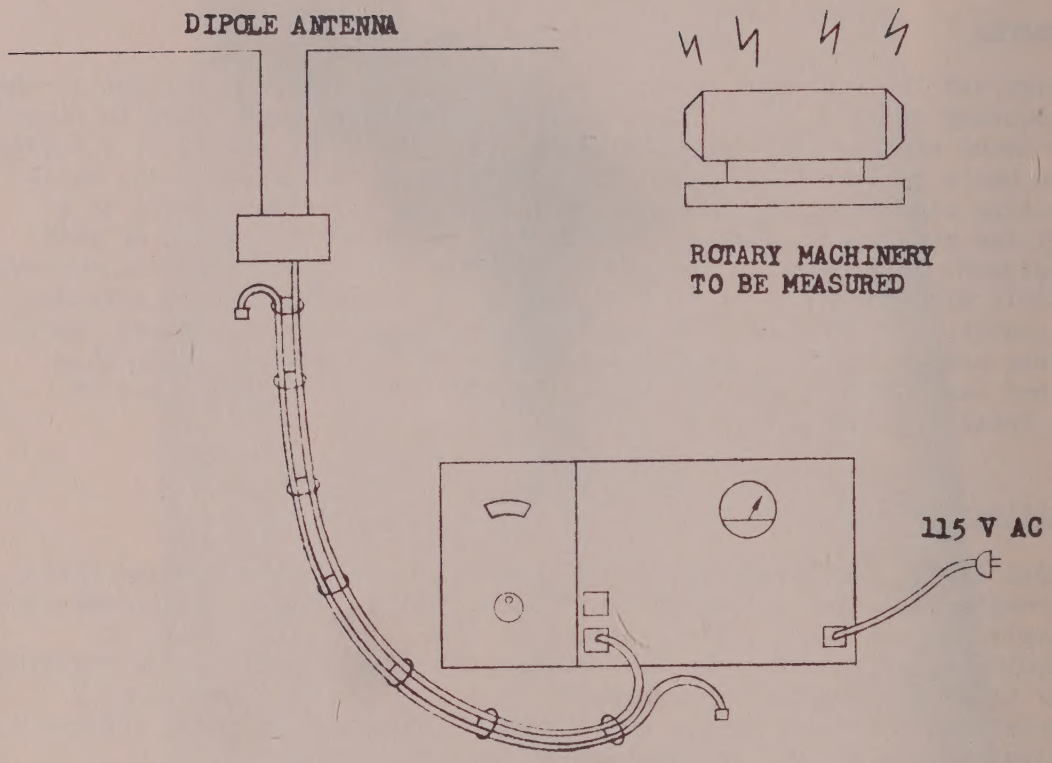


FIGURE 1 - TYPICAL APPLICATION OF NF-105

VOLTAGE RANGE AS A TWO-TERMINAL R. F. VOLTMETER:

Interference measurements: $\frac{1}{BW(MC)}$ to $\frac{100,000}{BW(MC)}$ microvolts/MC

Carrier intensity measurements: 1 to 100,000 microvolts

INPUT IMPEDANCE: 50 ohms

CALIBRATING IMPULSE NOISE SOURCE:
Pulse repetition rate: 2.5 to 2,500 cycles
Pulse spectrum: Flat to 1000 MC within ±1/2 DB
Pulse amplitude: variable from 37 to 97 DB above 1 microvolt per megacycle bandwidth.

INDICATING METER: 4½" logarithmic movement calibrated in microvolts (0.5 to 10) and decibels (-6 to +20).

WEIGHT: Basic Measuring Unit with a Tuning Unit - 71 lbs.

SIZE: Basic Measuring Unit - 18-3/4" wide X 9½" high X 14-5/8" deep.

4. List of Components

Noise and Field Intensity Meter Model NF-105 consists of the components listed below.

Quantity	Name of Component	Catalog No.	Dimensions (in.) Height	Width	Depth
1	Basic Measuring Unit (Main Unit)	BA-105	9-1/2	18-3/4	14-5/8
1	Tuning Unit, 150 KC - 30 MC	T-A/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 20 MC - 200 MC	T-1/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 200 MC - 400 MC	T-2/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 400 MC - 1000 MC	T-3/NF-105	8-1/2	6-1/4	11-3/4
1	R.F. Patch Cord (6 inch)				
1	R.F. Patch Cord (18 inch)				
1	AC Line Cord				
1	Standard Accessory Kit, 20-1000 MC consisting of the following items	KT-105-B	16	23-1/2	14-1/2
1	Accessory Carrying Case	AC-105-B	16	23-1/2	14-1/2
1	Dipole Antenna Set (20-200 MC)	DM-105-T1	4-1/2	21-1/2	3-1/2
1	Dipole Antenna Set (200-400 MC)	DM-105-T2	4-1/2	21-1/2	3-1/2
1	Dipole Antenna Set (400-1000 MC)	DM-105-T3	4-1/2	21-1/2	3-1/2
1	Tripod (collapsed)	TP-105	21-5/8	4	3-1/4
1	Line Probe (50 ohms)	LL-105	3	2-1/2	2-1/2
1	Magnetic Field Probe	MP-105	10	3-1/2	1
1	Electric Field Probe	EP-105	8-3/4	2-3/4	2-3/4
1	Injection Block	UN-105	2	2-1/2	1
2	30 ft. R.F. Cables	CB-105			
1	Earphones	EA-105	6	6	1
1	Alignment Harness	AH-105	2-1/2	3-1/2	3-1/2
1	Grounding Strap (3 ft.)	GR-105			
3	Antenna Masts	MA-105	20	1	1
1	Mast Socket	MS-105	3	1-1/2	1-1/2
1	Broad Band Antenna Cone	BB-105	9-1/2	8	8
1	Broad Band Antenna Plane	BB-105	1/2	24	24
6	Broad Band Antenna Rods (2 ft.)	BB-105			
1	Inverter for 12 V DC Operation	MO12-105	6-3/4	9-7/8	5-5/8
1	Inverter for 24 V DC Operation	MO24-105	6-3/4	9-7/8	5-5/8
1	DC Supply Cord (6 ft.)	DC-105			
1	Remote Indicator	RE-105	4-1/2	4-5/8	4-1/2
1	Remote Indicator Cable (25 ft.)	RC-105			
1	Line Probe (500 ohms)	LH-105	3	2-1/2	2-1/2
1	Carrying Case for Optional Equipment	OC-105	25-1/2	28-1/4	11-3/4
1	Carrying Case for a Tuning Unit	TC-105	15-1/2	7-3/4	10-1/2
1	Antenna Equipment for T-A/NF-105	LM-105			

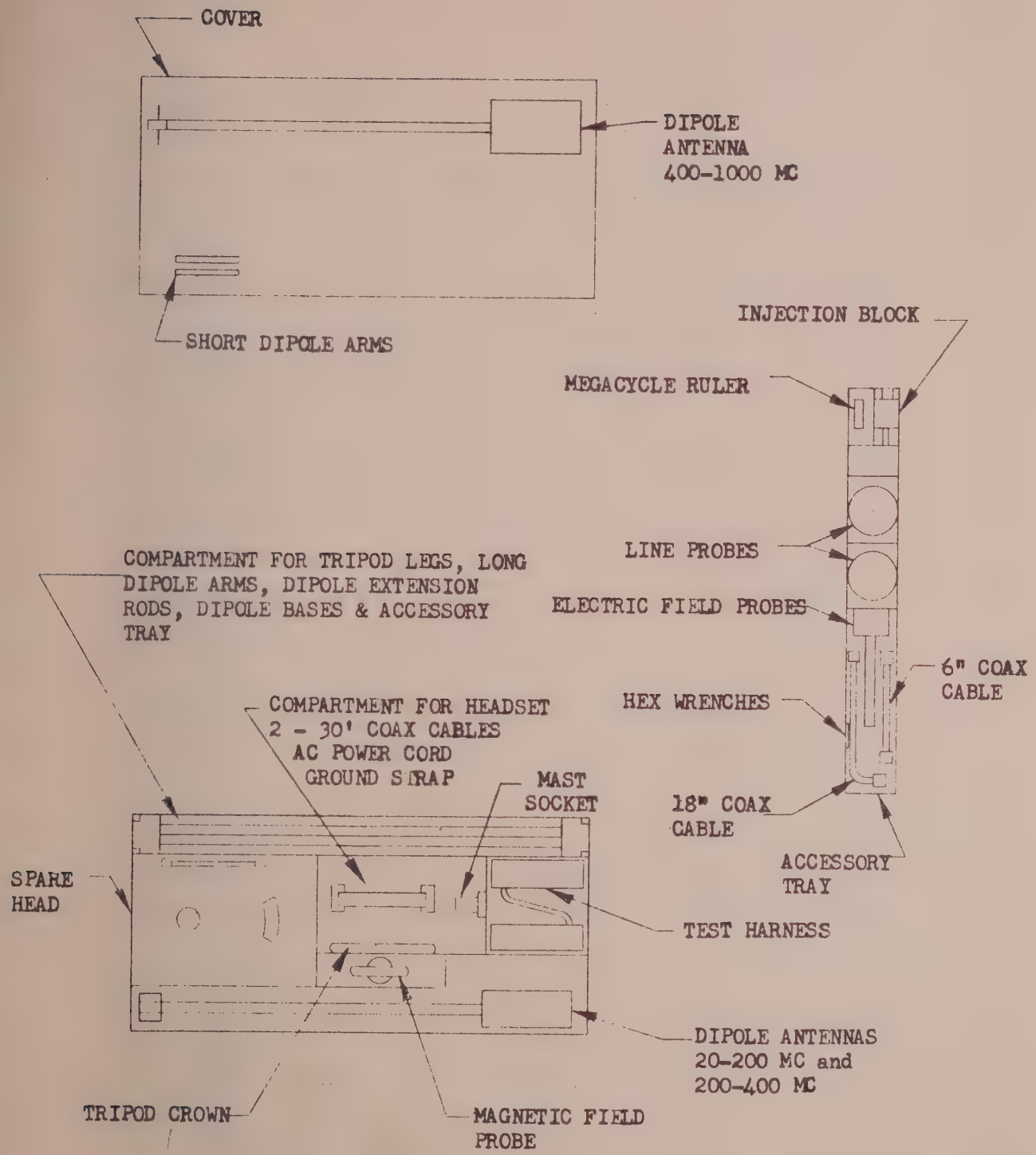


FIGURE 2 - ARRANGEMENT OF PARTS IN ACCESSORY TRANSIT CHEST

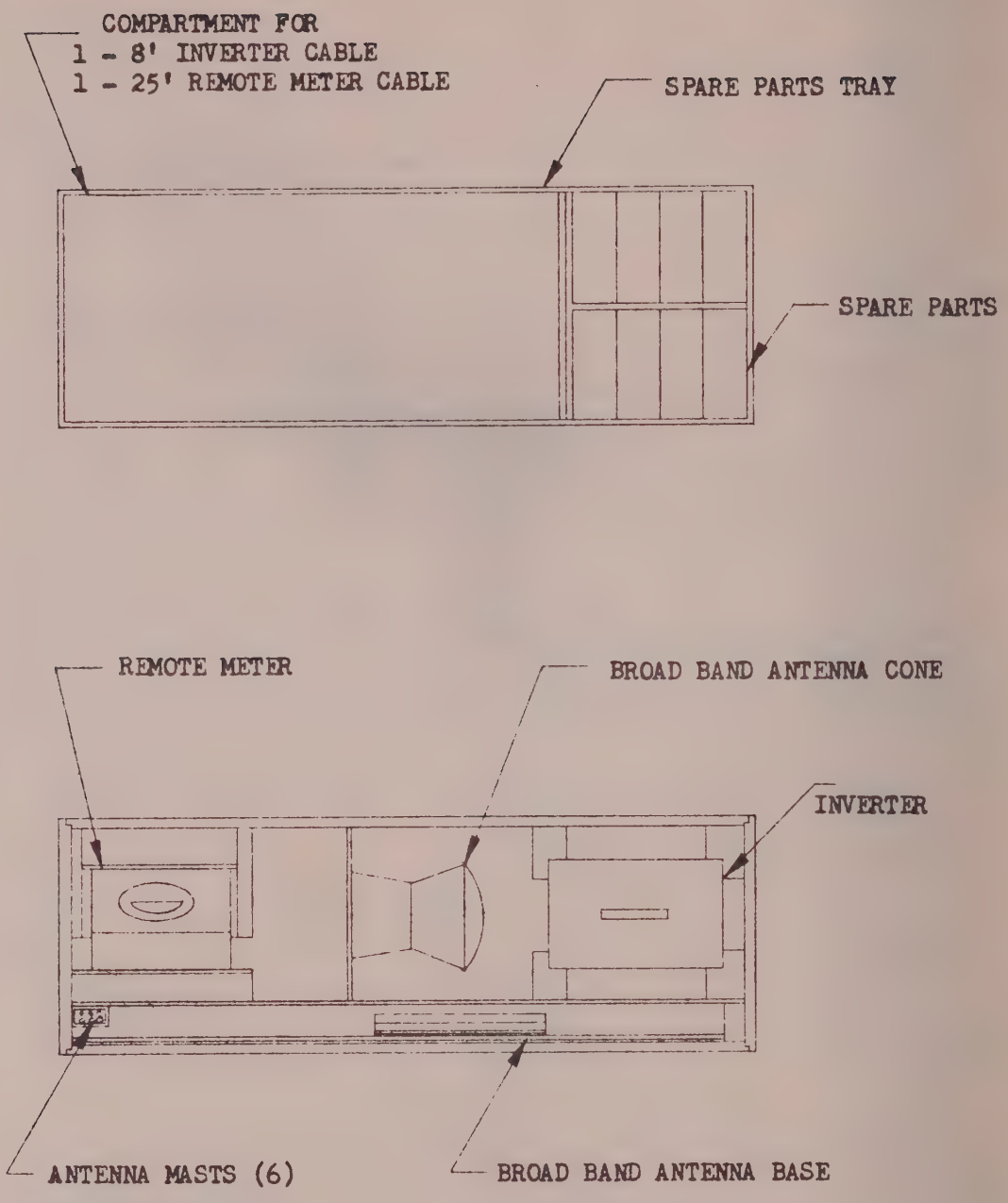


FIGURE 3 - ARRANGEMENT OF PARTS IN OPTIONAL EQUIPMENT TRANSIT CHEST

5. Description of Major Components

The Basic Measuring Unit of Noise and Field Intensity Meter Model NF-105, in conjunction with the R. F. plug-in heads, contains all tubes and associated circuits. It is housed in an aluminum case provided with a gasketed front cover.

Of the four R. F. plug-in heads available, one is normally carried plugged into the main unit. The other three R. F. plug-in heads may be individually stored in carrying cases for tuning unit (TC-105) or alternately one of them may be inserted in the accessory carrying case (AC-105). (Figure 2)

For three of the tuning heads (T-1/NF-105, T-2/NF-105 and T-3/NF-105), there is a corresponding dipole antenna set consisting of a balun transformer and dipole arms. A mounting base and three extension mast rods are provided to mount any of the dipole antennas on the tripod.

Antennas for Tuning Unit T-A/NF-105 are covered in a separate manual.

The broad band antenna consists of a cone equipped with fittings for extension rods, 6 extension rods and a ground plane.

All antennas may be mounted on an adjustable wooden tripod.

The magnetic field probe consists of a three-inch electrostatically shielded pick-up loop attached to a handle. In order to minimize shock hazard, the probe is insulated.

The electric field probe consists of a pick-up disc housed in a shielded container with an unshielded top permitting signal pick-up from one direction only. Like the magnetic field probe, this probe is insulated.

The two line probes differ in that one is a 50 ohm and the other a 500 ohm pick-up device. Each probe is housed in a shield and is equipped with binding posts for easy attachment to the line to be evaluated. The probe is capacitively coupled to the line.

The remote indicator contains a meter duplicating that on the main instrument panel. An earphone jack is provided to facilitate aural monitoring.

The DC inverters are of the rotary type furnishing the 115 volts 60 cycle power needed to operate the equipment.

The headset is designed for 600 ohms impedance.

An injection block is provided for use with the broad band antenna.

A grounding strap serves to protect the operator from electrical shock when touching the equipment.

An alignment harness is provided for R. F. and I. F. alignment of the plug-in heads. It consists of two small metal containers housing the appropriate circuits, connectors and connecting leads.

SECTION II

Installation and Assembly

6. Selection of Site

When setting up the equipment for interference measurements, it should be so located that the appropriate antenna or probe can reach the interference source when connected through the 30-foot length of R. F. cable. When using the equipment for field intensity measurements, a site must be chosen which is free from trees, electrical power and telephone lines, metal fences, buildings and other projections that might interfere with the field strength pattern.

7. Assembly and Interconnections

Ascertain that the plug-in head covering the desired frequency range is inserted in the main unit. If not, loosen the head latch located near the left edge of the main panel (see Figure 4). Holding back or locking the latch to clear the panel of the plug-in head, pull the handle located near the left edge of the plug-in head. Insert the head covering the desired frequency range in the main unit, again holding the latch of the locking mechanism. After fully inserting the head, release the latch which will then rest against the front of the plug-in head panel. Tighten the locking screw. Remove from the accessory carrying case such additional components as may be required, including the following:

a. R. F. patch cord - 6 inches. Connect this cord between the ATTEN. OUTPUT connector near the left edge of the equipment panel and the connector on the plug-in head; if the head used has more than one frequency range the cord must be attached to the connector corresponding to the frequency range desired.

b. R. F. patch cord - 18 inches. This cord is used with shunt calibration to connect the IMPULSE GEN. or SINE WAVE GEN. to the SIGNAL INPUT receptacle.

c. AC line cord. This cord leads from the AN connector located on the right side of the equipment panel (beneath the fuse post) to the 115 volts, 50 to 400 cycles power source.

d. Inverter. If the equipment is to be operated from a battery, the inverter corresponding to the available DC voltage (12 or 24 V) is used. Connect the free end of the AC power cord to the outlet on the side of the inverter.

e. DC power cord. By means of the DC power cord, connect the inverter to the battery. If the battery is part of a grounded system, always connect the black lead of the DC power cord to the grounded terminal of the battery, regardless of the battery polarity.

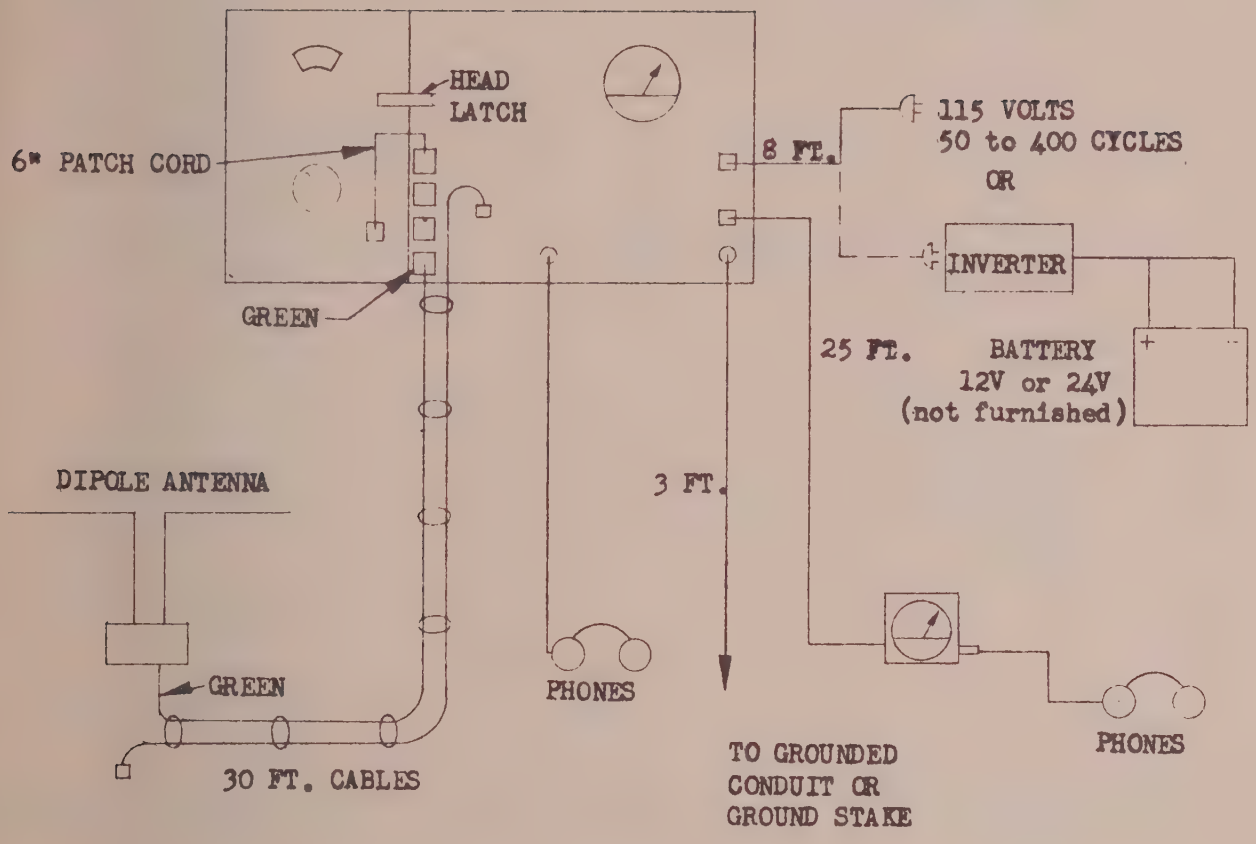


FIGURE 4 - INTERCONNECTION BETWEEN VARIOUS COMPONENTS

f. Remote indicator. In certain instances, it may be desirable to use the remote indicator in order to observe readings and have an aural monitor some distance from the location of the main unit.

g. Remote indicator cable. When the remote indicator is to be used, it is connected to the main unit by means of this 25-foot cable. The cable is attached to the main unit by means of an AN connector, located near the lower right hand corner of the front panel.

h. Headset. The headset is plugged into the PHONES jack located near the lower left hand corner of the main equipment panel, or may be inserted into the jack on the remote indicator unit.

i. Grounding strap. The plug-end of the grounding strap is inserted in the jack marked GROUND located in the lower right hand corner of the front panel; the other end of this cord may be connected to any suitable ground.

j. R. F. cables. The two 30-foot R.F. cables are taped together at fixed intervals in order to prevent shifting in their relative position. These cables must be used for all measurements since substitution of other cables of different types or having different lengths will disturb the measuring accuracy. When connecting the cables, the color coding must be observed. Attach one of the green plugs of the cable to the SIGNAL INPUT connector, also carrying the green marking and located in the lower left hand corner of the panel. The companion cable marked red is used only with the series method of calibration described in par. 10.4.

k. Injection block. The injection block is used only in conjunction with the broad band antenna.

l. Magnetic field probe. In order to pick up the magnetic field component of R.F. interference (for relative readings only), the magnetic field probe is used.

m. Electric field probe. For the electric field component of R. F. interference, the electric field probe is used. Attach its connector to the 30-foot cable with the green marking.

n. Line probes. If conducted interference is to be measured, select either the 50 or 500 ohm line probe, depending upon the impedance with which it is desired to load the line. Attach its connector to the 30-foot. R.F. cable, with the green connector. If an unbalanced circuit is to be measured, connect the side which is grounded or is electrically closest to ground to the binding post marked by one dot. The "high" side is fed to the binding post marked by two dots. If a balanced circuit is to be evaluated, connect its center tap to the post marked by one dot, ground this post if no center tap is available. Connect the two "high" sides of the two remaining binding posts. The unmarked binding post is merely connected so that the probe provides a balanced load for

the line. Therefore, the connections to the two "high" sides must be reversed, in order to obtain noise measurements for both sides of the balanced line.

o. Tripod. If the dipole or the broad band antenna is to be used, the tripod is employed as a supporting base. Attach the tripod crown to the legs and extend the legs to the desired height. Tighten the leg locking screws securely. For greater rigidity, the legs may be braced by means of the spreader.

p. Broad Band antenna. In order to operate the broad band antenna, its plane, cone and extension rods are needed. Remove the rods on the tilt plate (near the center of the base) from their support clips, and insert them into the stud holes. This will permit angular adjustment of the antenna. Attach the antenna base to the tripod by securely fastening the two thumbscrews located in the tripod crown to the corresponding holes in the tilt plate. By means of the three fasteners in the cone flange, attach the cone to the ground plane. The cone extension rods are inserted into the holes on top of the cone, in order to obtain maximum operating efficiency of the antenna in the frequency range desired. Proceed in accordance with Figure 5. After the antenna is completely assembled on the tripod, connect the injection block to the connector from underneath the antenna base.

q. Dipole antenna. There are three dipole antenna sets covering the range of 20 - 1000 MC as follows:

20 - 200 MC	(DM-105-T1)
200-- 400 MC	(DM-105-T2)
400 -1000 MC	(DM-105-T3)

Each set consists of a bakelite tube having a dipole block on one end and a matching transformer on the other. On the 20 - 200 MC and 200-400 MC sets, the dipole arms are separate and are attached to threaded inserts on the opposite sides of the dipole block. There are two loose (unattached) pairs of adjustable dipole arms; one pair covering the frequency range of 27 to 140 MC, the other pair from 140 MC to 400 MC. Because of physical size, the maximum extended length of the low frequency dipole arms was limited to correspond to 27 MC. For frequencies from 20-27 MC, the dipole is extended to its maximum length. The chart of Figure 9 allows for the reduced effective height in this range. On the 400-1000 MC set, the dipole arms are permanently attached to the block. To use any of the dipole antennas, attach the bakelite tube to the tripod mast by means of the clamp. Secure the mast base to the tripod crown by tightening the off-center thumbscrew. Insert the mast into the socket on top of the base. If desired one or two additional mast sections may be inserted. Tighten the centrally located thumbscrew on the tripod crown thus locking the mast and the base to the tripod. The dipole may be rotated about a horizontal axis by loosening the bakelite clamp thumbscrew. When the desired position is obtained, tighten this thumbscrew.

BROAD BAND ANTENNA
20—1000 MCS

FIG. 5

r. Megacycle ruler. The megacycle rules are used to extend the dipole arms to the proper length for the desired operating frequency. To cover the range of 20-400 MC, use the steel tape rule. For the range of 400-1000 MC, the engraved bakelite rule is employed. When using the steel tape measure from the exact center of the dipole to the extreme tip of one dipole arm. Repeat procedure on the other arm. When using the bakelite rule measure from the plastic block which supports the dipole arms.

FIGURE 6 APPLICATIONS AND METHODS OF MEASUREMENT

APPLICATION	UNIT OF MEASUREMENT	PICK UP DEVICE	COUPLING DEVICE	CALIBRATION METHOD	CALIBRATOR	METHOD OF MEASUREMENT	INDICATION
Noise Measurement (Peak)	Microvolts per MC bandwidth or Microvolts per KC bandwidth	Dipole Probes a.Line-50 ohms b.Line-500 ohms c.Magnetic* d.Electric*	None	Shunt	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
		Broad band antenna	Injection Block	Series	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
Noise Field Intensity (Peak)	Microvolts per MC bandwidth per meter or Microvolts per KC bandwidth per meter	Dipole	None	Shunt	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
Two-Terminal RF Voltmeter (Carrier)	Microvolts	Any	None	Shunt	20-400 MC Sine Wave Gen. 400-1000 MC Impulse Gen.	Direct Reading	Meter
Carrier Field Intensity	Microvolts per meter	Dipole	None	Shunt	20-400 MC Sine Wave Gen. 400-1000 MC Impulse Gen.	Direct Reading	Meter

* Comparative Measurements Only

PART TWO - OPERATING INSTRUCTIONS

SECTION III

Operation

8. Applications and Methods of Measurement

Figure 6 tabulates the applications together with data required to calibrate and operate the instrument.

There are four major types of application as follows:

1. Noise Measurements (Peak)
2. Noise Field Intensity
3. Two-Terminal R.F. Voltmeter (Carrier)
4. Carrier Field Intensity

8.1. For noise measurements the output of the internal impulse generator is directly compared to the level of the unknown signal. Indication may be visual (meter) or aural (slideback).

The slideback method offers two advantages over the visual method. It makes it possible to differentiate between two or more types of interference simultaneously present; also it may be used at very low repetition rates, even for single impulses. Thus the slideback method should be used when the repetition rate is below 50 cycles.

In an alternate method, the internal impulse generator is used to calibrate the instrument which then becomes direct reading in terms of microvolts per megacycle bandwidth applied at the input receptacle.

In both cases, shunt calibration is employed, i.e. the calibrating voltage is applied at the same input receptacle which is to be used for the unknown voltage.

When the broadband antenna is used, series calibration is employed. In this case, the calibrating voltage is injected at the antenna in series with the unknown voltage.

8.2. Noise Field Intensity Measurements are performed in the identical manner as noise measurements using the dipole, except that the effective height of the dipole antenna is taken into account.

8.3. Two-Terminal R.F. Voltmeter. For T-1/NF-105 and T-2/NF-105 the Sine Wave generator is used to calibrate the instrument so that it is direct reading in terms of microvolts applied at the input receptacle.

For T-3/NF-105, the Impulse Generator is used as the calibrating standard.

8.4. Carrier Field Intensity measurements are performed by first calibrating as a two-terminal R.F. voltmeter. Then the effective height factor is applied to produce readings in microvolts per meter.

NOTE: The methods of 8.3 and 8.4, although stated as indicating carrier values, may be utilized to show peak values of modulating carriers. For the sake of simplicity, this variation of 8.3 and 8.4 has not been listed in Figure 6.

9. Control Settings

Before attempting to operate this equipment, make certain that the controls are set to the positions indicated.

CONTROL	POSITION
Function Switch	METER BAL
IMPULSE GEN. OUTPUT	90 DB above 1 μv/MC

NOTE: The IMPULSE GEN. OUTPUT and SIGNAL INPUT ATTENUATOR control knobs must be pulled out before being turned. Turning without first pulling forward may damage these attenuators. Upon lining up the dot on the control knob with the desired position, push knob all the way in.

SIGNAL INPUT ATTENUATOR	20 DB

NOTE: When the SIGNAL INPUT ATTENUATOR is in the 0 DB position use the orange scales on the large meter. For all other positions, read the black scales.

The conversion charts Figure 7 are provided for convenience in converting from "DB above one microvolt" to "microvolts" and from "DB above one microvolt per megacycle" to "microvolts per kilocycle".

IMPULSE GEN. P.R.R.	X100
CYCLES	10
SINE WAVE OSC. - IMPULSE GEN.	OFF
METER	INT.
POWER	OFF
POWER (on inverter, when used)	OFF (down)
SLIDEBACK	Max. clockwise

DB ABOVE 1 MICROVOLT
TO
MICROVOLTS

OR

DB ABOVE 1 MICROVOLT PER MEGACYCLE BANDWIDTH (DBMC)
TO
MICROVOLTS PER MEGACYCLE BANDWIDTH

Total DB OR DBMC	20	30	40	50	60	70	80	90
0	10.0	31.6	100	316	1000	3160	10000	31600
1	11.2	35.5	112	355	1120	3550	11200	35500
2	12.6	39.8	126	398	1260	3980	12600	39800
3	14.1	44.7	141	447	1410	4470	14100	44700
4	15.8	50.1	158	501	1580	5010	15800	50100
5	17.8	56.2	178	562	1780	5620	17800	56200
6	20.0	63.1	200	631	2000	6310	20000	63100
7	22.4	70.8	224	708	2240	7080	22400	70800
8	25.1	79.4	251	794	2510	7940	25100	79400
9	28.2	89.1	282	891	2820	8910	28200	89100
10	31.6	100.0	316	1000	3160	10000	31600	100000

MICROVOLTS

OR

MICROVOLTS PER MEGACYCLE BANDWIDTH

FIGURE 7A - CONVERSION CHART

DB ABOVE 1 MICROVOLT PER MEGACYCLE (DBMC)
TO
MICROVOLTS PER KILOCYCLE BANDWIDTH

TOTAL DBMC	20	30	40	50	60	70	80	90
0	.010	.031	.10	.31	1.0	3.1	10.0	31
1	.011	.035	.11	.35	1.1	3.5	11.0	35
2	.012	.040	.12	.40	1.2	4.0	12.0	40
3	.014	.044	.14	.44	1.4	4.4	12.0	44
4	.015	.050	.15	.50	1.5	5.0	15.0	50
5	.017	.056	.17	.56	1.7	5.6	17.0	56
6	.020	.063	.20	.63	2.0	6.3	20.0	63
7	.022	.070	.22	.70	2.2	7.0	22.0	70
8	.025	.079	.25	.79	2.5	7.9	25.0	79
9	.028	.089	.28	.89	2.8	8.9	28.0	89
10	.031	.100	.31	1.00	3.1	10.0	31.0	100

MICROVOLTS PER KILOCYCLE BANDWIDTH

FIGURE 7B - CONVERSION CHART

I.F. GAIN	Max. clockwise
VOLUME	Max. clockwise

9.1. Initial Adjustment

Turn POWER switch on and, when using the inverter, also turn on the toggle switch located next to its DC connector, thereby powering the equipment. Allow a five minute warm-up period before attempting to calibrate.

Adjust the METER BAL. control, located in the upper left hand corner, for zero reading on the large meter. Set function switch to ZERO ADJ. and turn the ZERO ADJ. control until the meter again reads zero. Repeat as required.

10. Noise Measurements

10.1. Visual Substitution (meter)

Turn the function switch to PEAK and leave it in this position for all peak measurements.

Connect the desired pick-up device to the SIGNAL INPUT receptacle by means of the 30 foot cable.

If the dipole antenna is to be used, adjust the dipole arms to the proper length for the frequency at which the measurement is to be taken. The megacycle rules are provided for this adjustment. Placement of the dipole antenna relative to the source of R.F. noise should be in accordance with the applicable specification or requirement.

Tune to the desired frequency. Adjust SIGNAL INPUT ATTENUATOR and IF GAIN to produce a reference reading. Use as much signal input attenuation as is consistent with good signal to noise ratio. After the reference reading has been obtained, disconnect the 30 foot cable from the SIGNAL INPUT receptacle and connect the 18 inch cable from the IMPULSE GEN. receptacle to the SIGNAL INPUT receptacle. Turn on the impulse generator by rotating the SINE WAVE OSC. IMPULSE GEN. switch to the IMPULSE GEN. position. This switch is located below the SIGNAL INPUT ATTENUATOR.

NOTE: If no impulse generator signal is audible in the headset, slowly turn the IMPULSE GEN. FINE CONTACT ADJ. over its entire range. Should this fail to produce a signal in the headset, set the IMPULSE GEN. CONTACT PRE-ADJ. control as described in Section V, Par. 26.

After adjusting the impulse generator, its repetition rate may be lowered to any value. However, for visual indication greatest accuracy is obtained with repetition rates above 100 per second.

By means of the step and variable controls, adjust the IMPULSE GEN. OUTPUT to match the reference reading previously obtained. (The impulse generator output in DB above 1 microvolt per megacycle is the sum of the readings of the IMPULSE GEN. OUTPUT and of the small meter.) This is the level of the unknown signal in DB above one microvolt per megacycle bandwidth at the input receptacle.

If the level of the unknown signal fluctuates, the measurement should be made at the highest reading unless otherwise stipulated in the applicable specification.

Since the insertion loss of the SIGNAL INPUT attenuator is the same for both unknown and calibrating signals, its reading need not be considered. If, however, the level of the unknown signal is higher than the maximum output of the impulse generator, it will be necessary to reduce the insertion loss of the SIGNAL INPUT attenuator when applying the calibrating signal. In this case, the change in SIGNAL INPUT attenuator setting in DB must be added to the impulse generator reading. Conversely, if the level of the unknown signal is lower than the lowest output of the impulse generator, it will be necessary to increase the insertion loss of the SIGNAL INPUT attenuator when applying the calibrating signal. In this latter case, the change in SIGNAL INPUT attenuator setting in DB must be subtracted from the impulse generator reading.

Since there is a slight signal attenuation in the 30 foot cable, it is necessary for full accuracy to add a correction factor for this cable loss, which factor is obtained from Figure 8.

If the measurement was made with the dipole antenna a mismatch occured since the theoretical 72 ohm impedance of the dipole was terminated in the 50 ohm input impedance of the receiver. In order to compensate for this mismatch add 1.7 DB to the indicated reading. If, as required by some specifications, open circuit voltage (antenna induced voltage) is desired, an additional factor of 6 DB must be added.

When changing frequency ranges on T-1/NF-105 (20-200 MC) or T-3/NF-105 (400-1000 MC), turn the knob located to the left of the dial window to the desired range. In addition, change the connection of the patch cable on the head to correspond with the frequency range in use. Recalibrate the new frequency by following the procedure outlined above. When changing to a new frequency plug-in head, calibrate in a like manner.

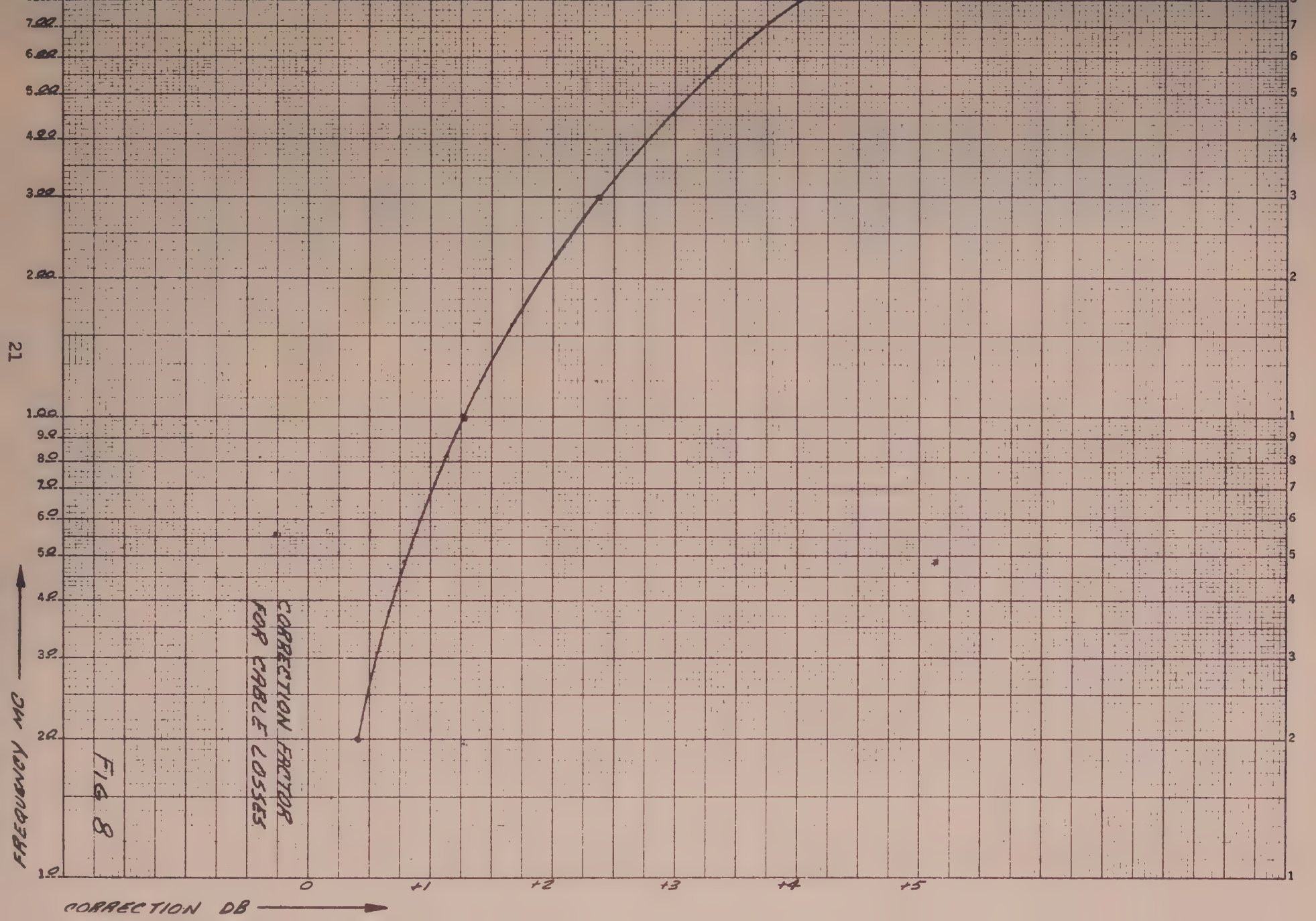

7.00
6.00
5.00
4.00
3.00
2.00
1.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
0
+1
+2
+3
+4
+5
CORRECTION DB
FREQUENCY MC
CORRECTION FACTOR
FOR CABLE LOSSES

FIG 8

10.2. Aural Substitution (slideback)

Another method of indication for the substitution method is by aural means using slideback. This latter method, in fact has several advantages over visual substitution (see Par. 8.1.).

If the slideback method of indication is to be employed, proceed as follows:

Choose the probe or antenna to be used and connect it to the main unit. Set the TUNING control to the desired frequency. Set the SIGNAL INPUT ATTENUATOR to the highest insertion loss which will still permit listening to the unknown noise. Set the IF GAIN control to about 60 or 70% of maximum clockwise position and scan by keeping the slideback control at the point at which the peaks of the unknown signal are barely audible in the phones. Alternately, set the slideback control at 50% rotation and follow with just sufficient gain to maintain this level in the phones.

NOTE: Setting the IF GAIN control near its minimum gain position may result in receiver overload causing erroneous readings.

Adjust the SLIDEBACK control until the noise is at the threshold of audibility.

Disconnect the 30 foot cable from the SIGNAL INPUT receptacle and connect the 18 inch cable from the IMPULSE GEN. receptacle to the SIGNAL INPUT receptacle. Do not change the SLIDEBACK or the IF GAIN control settings until the measurement is completed. Turn on the impulse generator and vary its output until it is audible in the earphones. Adjust the IMPULSE GEN. P.R.R. control and the CYCLES switch until the P.R.R. agrees with that of the unknown signal if possible. (This is a convenience and not a condition to obtaining accurate results). Adjust the amplitude of the internal noise calibrator by varying the IMPULSE GEN. OUTPUT attenuator and the ADD TO IMPULSE GEN. OUTPUT control until the output produced in the earphones is at the threshold of audibility as was the unknown. Add the IMPULSE GEN. OUTPUT reading and that of the ADD TO IMPULSE GEN. OUTPUT meter. Note the sum of the two readings. This is the level of the unknown signal. For full accuracy apply the correction factor for cable loss (Figure 8).

If the measurement was made with the dipole antenna, the indicated signal level must be corrected by adding 1.7 DB to obtain the dipole voltage (see Par. 10.1). If open circuit voltage is desired add an additional factor of 6 DB.

If the level of the unknown signal is higher than the maximum output of the impulse generator or lower than its minimum output, the measurement may be made by operating the signal input attenuator as explained in Par. 10.1.

10.3. Noise Measurements - Direct Reading (Two-terminal R.F. voltmeter-noise.)

As an alternate method, the instrument may be calibrated as a two-terminal R.F. voltmeter.

This method is essentially the reverse of the methods described in Par. 10.1 and 10.2 in that the instrument is calibrated prior to taking readings of the unknown voltage and thus becomes direct reading in terms of microvolts per megacycle at the input receptacle.

Adjust METER BAL. and ZERO ADJ. controls. Set function switch to PEAK. Tune to the desired frequency (approximately). Connect the 18 inch cable between IMPULSE GEN. and SIGNAL INPUT receptacles. Turn on the impulse generator. Set SIGNAL INPUT ATTENUATOR to 40 DB, IMPULSE GEN. OUTPUT (The impulse generator output in DB above one microvolt per megacycle is the sum of the readings of the IMP. GEN. ATT. and of the small meter) to 80 DB above one microvolt per megacycle. Adjust IF GAIN for full scale reading on the meter. Turn off the impulse generator. The instrument is now calibrated for a full scale sensitivity of 80 DB above one microvolt per megacycle bandwidth. (/) The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL INPUT ATTENUATOR.

Full scale readings in the various SIGNAL INPUT ATTENUATOR positions will be as follows based upon the above calibration procedure.

SIGNAL INPUT ATTENUATOR SETTING DB	FULL SCALE SENSITIVITY DB ABOVE 1 uv/MC
0	40
20	60
40	80
60	100
80	120

(/) It must be noted that the sum of the readings in DB of the SIGNAL INPUT ATTENUATOR and of the large meter add up to 60 DB which differs by 20 DB from the full scale sensitivity mentioned above. This difference is due to the fact that the bandwidth of the instrument is considerably less than one megacycle.

When changing to a new frequency the IF GAIN control may require readjustment in order to maintain full scale reading of the calibrating voltage.

After the instrument has been calibrated, remove the 18 inch cable from the SIGNAL INPUT receptacle and connect the 30 foot cable with the green connectors between this receptacle and the desired pick-up device.

The calibration procedure outlined above utilizes the full sensitivity of T-1/NF-105. However, the higher frequency heads T-2/NF-105 and T-3/NF-105 have wider bandwidths and therefore they are capable of more noise sensitivity. To fully realize this extra sensitivity, the instrument may be calibrated at a lower level of impulse generator voltage by using more IF gain. In this case, the indicated readings must be increased by a factor equal to the amount by which the sensitivity was increased. The sensitivity should not be increased beyond the point where the receiver noise level becomes excessive.

For measurements in the presence of a high noise background, it is recommended that the substitution method (Par. 10.1 or 10.2) be used in preference to the direct reading method.

10.4. Noise Measurements - Broad Band Antenna

As indicated in the previous paragraphs, the shunt calibration method (calibration at input terminals of instrument) is applied when dipole antennas or line probes are used as pick-up devices. For the broad-band antenna, series calibration (calibration signal in series with unknown) is used. The series calibration method has the advantage not to require a change of connections; however, an extra factor of 20 DB must be applied since the injection block attenuates the calibrating signal by this amount.

To use this method, connect the unbalanced injection block to the broad band antenna. Attach both of the 30 ft. cables to the correspondingly color-coded receptacles on the injection block. The other ends of the cables are connected to the SIGNAL INPUT receptacles (green) and to the IMPULSE GEN. receptacle (red). Turn IMPULSE GEN. switch OFF.

Tune to the desired frequency. Adjust SIGNAL INPUT ATTENUATOR and IF GAIN to produce a reference reading on the large meter. Shut off the external noise source. Turn on the impulse generator. Adjust IMPULSE GEN. output to obtain thereference reading. Note the reading of the IMPULSE GEN. OUTPUT controls. The unknown voltage is 20 DB less than this amount due to the attenuation of the calibrating voltage in the injection block. The reading so obtained is the open circuit voltage.

For full accuracy, apply the cable loss correction factor. Note that the polarity of the cable loss correction factor depends upon the method of calibration. In the shunt calibration method, the instrument is calibrated to read voltage at its input terminals. The cable loss reduces the voltage between the signal source and the input terminals; therefore, the correction factor is positive. In the series calibration method, the calibrating voltage is injected at the pick-up device. This voltage is attenuated by the 30 foot cable so that the unknown signal is greater than the indicated value. Therefore, the correction factor is negative.

In the calibration procedure outlined above, meter indication was described. Slideback may also be used in a manner similar to that described in par. 10.2. In addition, the instrument may be calibrated to be direct reading, as outlined in par. 10.3.

11. Noise Field Intensity

Use the dipole antenna and calibrate by substitution or for direct reading as described in par. 10.1, 10.2 or 10.3. In order to take a reading, turn the antenna about a vertical axis until a maximum indication is accomplished. If the reading is either off scale or too low, change the setting of the SIGNAL INPUT ATTENUATOR until a reading is obtained within the central portion of the meter scale. The voltage picked up by the dipole is of the maximum value when the axis of the dipole arms is perpendicular to the direction in which the signal source is located. The dipole should also be rotated about a horizontal axis to give maximum response. It may be turned to any angle from horizontal to vertical. For accurate measurements, it is desirable to take three different readings, with the dipole antenna moved to different locations which are not in a straight line. The average of the three readings should then be used as the significant measurement. To obtain field strength readings in microvolts per megacycle per meter, add the dipole factor (Figure 9). This factor is composed of two frequency dependant variables namely:

Effective Height of the Dipole Antenna
Loss in the 30 foot Cable

and two constants, namely:

Mismatch from 72 ohm antenna to 50 ohm cable (1.7 DB)
Conversion to open circuit voltage (6 DB)

The reading thus obtained is the open circuit voltage picked up by the dipole. If loaded circuit voltage is desired it is necessary to subtract 6 DB.

FIGURE 9 - DIPOLE FACTOR

This factor consists of

a. Effective height (λ/π)

b. Loss in 30 foot of RG-55 cable

c. Mismatch between 72 ohm antenna and 50 ohm cable (1.7 DB)

d. Conversion to open circuit voltage (6DB)

12. Two Terminal R.F. Voltmeter - Carrier Measurement

12.1. Calibration Procedure for T-1/NF-105 (20-200 MC) and T-2/NF-105 (200-400 MC)

Connect the 18 inch cable between the SINE WAVE OSC. and the SIGNAL INPUT receptacles. Set the SIGNAL INPUT attenuator to 80 DB.

Turn the function switch to its extreme counter-clockwise position, in order to adjust the sine wave oscillator. With the SINE WAVE OSC.- IMPULSE GEN. switdh in its OFF position, adjust the OSC. ZERO control (next to function switch) for zero reading on the main indicating meter. Set the SINE WAVE OSC. - IMPULSE GEN. switch to SINE WAVE OSC. Adjust the OSC. LEVEL control (beneath the OSC. ZERO control) for full scale reading (CAL mark) on the main indicating meter. The sine wave oscillator must again be adjusted as stated above, if the R.F. plug-in head is changed.

Set the TUNING control on the R.F. head to "CAL" (approximately 63 MC on either band of the 20 to 200 MC head or 220 on the 200 to 400 MC Head).

Set the function switch to CARRIER position. Tune the receiver about its "CAL" marking on the dial until the signal from the sine wave oscillator causes maximum deflection. Adjust the IF GAIN control for full scale meter reading. The instrument is now calibrated as a two terminal vacuum tube voltmeter at this frequency with a full scale sensitivity of 100 DB above one microvolt (80 DB on SIGNAL INPUT ATTENUATOR plus 20 DB on meter).

The sensitivity may be increased, in 20 DB steps, to a full scale value of 20 DB above one microvolt by operating the SIGNAL INPUT ATTENUATOR. The value of an unknown voltage is the sum of the DB readings of the meter and of the SIGNAL INPUT ATTENUATOR.

In order to calibrate at other frequencies, substitute the impulse generator for the sine wave oscillator. The impulse generator in this case is used as a transfer standard. Remove the 18 inch cable from the SINE WAVE OSC. receptacle and connect it to the IMPULSE GEN. receptacle. Turn the function switch to PEAK. Set the SIGNAL INPUT ATTENUATOR to 40 DB. Adjust the impulse generator output by means of the IMPULSE GEN. OUTPUT attenuator and the ADD TO IMPULSE GEN. OUTPUT control until a full scale reading or any other convenient reference is obtained on the large meter.

Tune to the desired frequency. Without changing the impulse generator output level, readjust the I.F. GAIN control for the previously established reference reading on the large meter. Set function switch to CARRIER. The instrument is now calibrated at the new frequency.

Inasmuch as the accuracy of carrier measurements is somewhat affected by the slight bandwidth variations of the receiver for different frequencies, the bandwidth factors in DB, Figs. 10, 11 and 12, should be added to the reading in DB above one microvolt if full accuracy is desired. To convert from "DB above one microvolt" to "microvolt" use the conversion chart Figure 7.

When changing frequency ranges on T-1/NF-105 (20-200 MC) turn the knob located on the left of the dial window to the desired range. In addition, change the connection of the patch cable on the head to correspond with the frequency range in use. Recalibrate the new frequency by following the procedure outlined above. When changing to the new frequency plug-in head, calibrate in a like manner.

In the presence of high ambient interference or high hiss level of the equipment, an accurate carrier measurement may be performed in the following manner.

Note the meter reading in microvolts produced by the combined noise and carrier levels. Detune the equipment sufficiently to lose the carrier signal.

Note the reading produced by noise level alone. The following formula applies:

$S = \sqrt{A^2 - N^2}$ in which S is the unknown carrier level, A the combined noise and carrier level and N the noise level (all in microvolts). For example, if the combined noise and signal level is 50 microvolts and the noise level 30 microvolts, the true signal level would be $S = \sqrt{50^2 - 30^2}$ or 40 microvolts.

12.2. Calibration Procedure for T-3/NF-105

The method of calibration for T-3/NF-105 differs from T-1/NF-105 and T-2/NF-105 in that, the impulse noise generator is used for carrier calibration. This is permissible since both the level of the impulse generator and the bandwidth of the receiver are known. The bandwidth of the receiver is a consideration since the impulse noise sensitivity of the receiver is a function of its bandwidth. Thus, if the receiver had a bandwidth of one megacycle, its CW sensitivity in microvolts would equal its impulse sensitivity expressed in microvolts per megacycle bandwidth. If the

BANDWIDTH DATA FOR TUNING UNIT T-1/NF-105

SERIAL NO. 350

FREQUENCY IN MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB
20	.158	+0.8
30	.156	+0.7
40	.149	+0/3
50	.149	+0.3
60	.158	+0.8
65	.144	0

FIGURE 10

FREQUENCY IN MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB
62	.158	0
80	.167	+0.5
100	.167	+0.5
120	.167	+0.5
140	.162	+0.2
160	.162	+0.2
180	.158	0
200	.149	-0.5

FIGURE 11

BANDWIDTH DATA FOR TUNING UNIT T-2/NF-105

SERIAL NO. 350

FREQUENCY IN MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB
190	.313	-.1
200	.313	-.1
210	.324	+.2
220	.324	+.2
240	.331	+.4
260	.339	+.6
280	.339	+.6
300	.347	+.8
320	.347	+.8
340	.351	+.9
360	.351	+.9
380	.351	+.9
400	.351	+.9

FIGURE 12

CALIBRATION CHART FOR TUNING UNIT T-3/NF-105

SERIAL NO. 000

FREQUENCY IN MC	IMPULSE GEN. LEVEL IN DB ABOVE 1 μv/MC
1000	49.5
975	49.5
950	49.5
925	49.5
900	49.5
875	49.5
850	49.5
825	49.5
800	49.5
775	49.5
750	49.5
725	49.5
700	49.5

TYPICAL CHART FOR

ILLUSTRATION ONLY

700	49.5
675	49.5
650	49.5
625	49.5
600	49.5
575	49.5
550	49.5
525	49.0
500	49.2
475	49.5
450	49.5
425	49.5
400	49.5

FIGURE 13

receiver bandwidth were only 0.1 megacycle, the impulse noise calibrating voltage required for the previous CW sensitivity adjustment of the receiver would have to be increased by a factor of 10.

The calibration procedure is as follows. By means of the 18 inch cable, connect the impulse generator receptacle to the signal input receptacle and turn on the impulse generator. In view of the fact that the magnitude of cable losses is appreciable in this tuning range, the impulse noise source must always be applied through the 18 inch cable in order to avoid calibration errors.

Set the SIGNAL INPUT ATTENUATOR to 20 DB and the function switch to PEAK. Tune to the desired frequency. By means of the impulse generator output controls, adjust the impulse generator output to the value indicated in the chart (Figure 13).

The instrument now has a full scale sensitivity of 40 DB above one microvolt as a two-terminal vacuum tube voltmeter. By changing the signal input attenuator setting the sensitivity may be changed in 20 DB steps. To convert these readings to microvolts see the conversion chart Figure 7. Calibration by means of the impulse noise signal must at all times be made with the function switch in the PEAK position, although the instrument is being calibrated to be used for carrier measurements. After calibration has been performed, carrier measurements are taken with the function switch in the CARRIER position. Readings must be taken in the PEAK position, however, if the peak value of a modulated carrier is to be measured.

In the presence of high ambient interference or high hiss level of the equipment, an accurate carrier measurement may be made, by taking readings of signal plus noise and then noise alone as outlined in par. 12.1.

13. Carrier Field Intensity

Calibrate as a two-terminal R.F. voltmeter in accordance with the methods described in par. 12.1 or 12.2.

Use the dipole antenna. In order to take a reading, turn the antenna about a vertical axis until a maximum indication is accomplished. If the reading is either off scale or too low, change the setting of the SIGNAL INPUT ATTENUATOR until a reading is obtained within the central portion of the meter scale. The voltage picked up by the dipole is the maximum value when the axis of the dipole arms is perpendicular to the direction in which the signal source is located. The dipole should also be rotated about the horizontal axis to give maximum response. For accurate

measurements, it is desirable to take three different readings, with the dipole antenna moved to different locations which are not in a straight line. The average of the three readings should then be used as the significant measurement. To obtain field strength readings in microvolts per meter, add the dipole factor (Figure 9).

This factor is composed of two frequency dependant variables namely:
- Effective Height of the Dipole Antenna
- Loss in the 30 foot cable

and two constants, namely:
- Mismatch from 72 ohm antenna to 50 ohm cable (1.7 DB)
- Conversion to open circuit voltage (6 DB)

The reading thus obtained is the open circuit voltage picked up by the dipole. If loaded circuit voltage is desired it is necessary to subtract 6 DB.

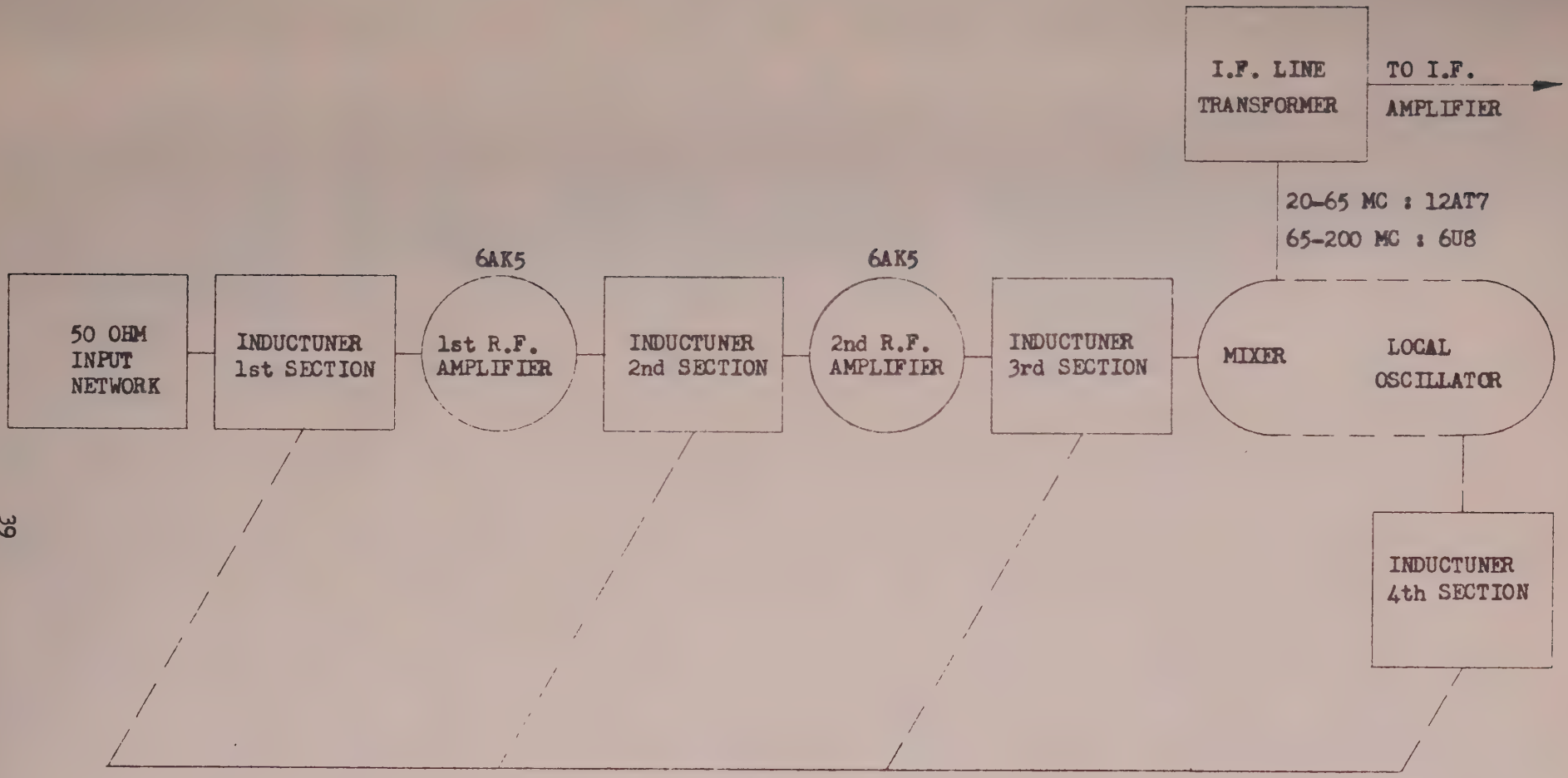


FIGURE 14 - BLOCK DIAGRAM OF R.F. AMPLIFIERS (20-200 MC)

PART THREE - REPAIR INSTRUCTIONS

SECTION IV

Theory of Operation

14. Tuning Unit T-1/NF-105

Tuning unit T-1/NF-105 covers the frequency range from 20 to 200 MC in two bands. There are two separate R.F. amplifiers, one covering the frequency range from 20 to 65 MC, and the other from 65 to 200 MC.

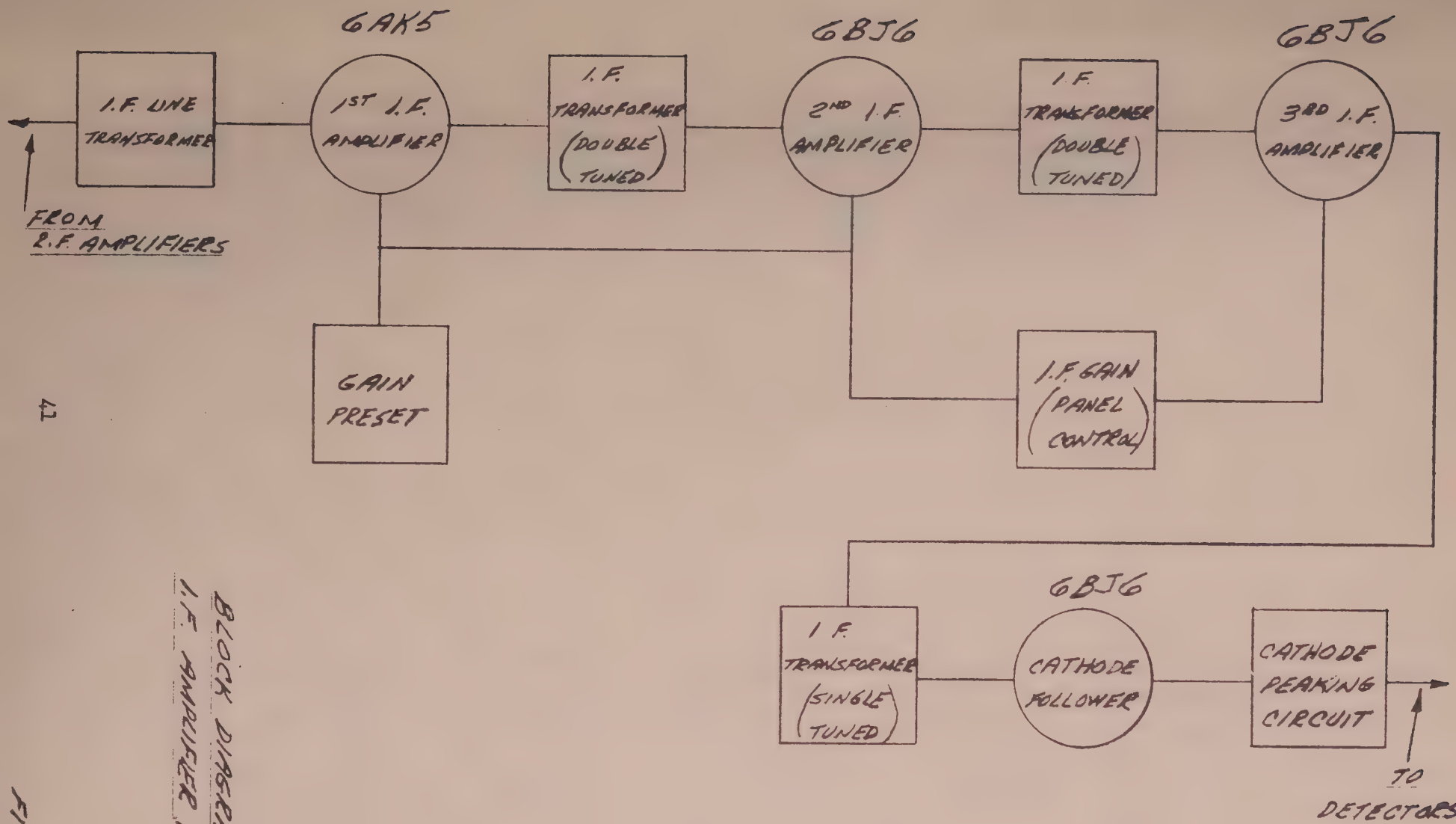
Each R.F. amplifier uses a four-section "Inductuner" as its variable tuning element. Each section of the Inductuner consists of a continuously variable inductor which in conjunction with the proper capacitor, end inductor and, in some instances, shunt inductor, covers the desired frequency range.

A block diagram of the R.F. amplifiers is shown in Figure 14, detail schematic illustration in Figure 27.

In order to keep the input voltage standing wave ratio (VSWR) to a low value, thus obtaining high measuring accuracy, the input circuit is made to appear as a 50 ohm load at the input terminal. Although this results in a deterioration in noise figure, this compromise between VSWR and noise figure is necessary for the sake of measuring accuracy. From the input, the signal is fed through the first tuned circuit to the grid of the first R.F. amplifier (6AK5). The plate of this stage is directly fed into the second tuned circuit, which in turn is capacitively coupled into the grid circuit of the second R. F. amplifier (6AK5). The signal obtained in the plate circuit of this stage is applied to the third tuned circuit, which is coupled to the grid of the mixer stage (half of a 12AT7 in the 20 to 65 MC range, half of a 6U8 in the 65 to 200 MC range). The other section of the mixer tube serves as the local oscillator. Inasmuch as a 10.7 MC I.F. frequency is employed, the oscillator generates a frequency which is, for all tuning positions, 10.7 MC higher than the corresponding R.F. frequency. The resultant difference frequency of 10.7 MC is applied from the plate circuit of the mixer into the I.F. line transformer.

Local oscillator injection in the 20 to 65 MC range is accomplished by means of a 5 mmf capacitor (C78); in the 65 to 200 MC range, a 2 mmf injection capacitor is employed (C105).

Change-over of the two frequency ranges here discussed is accomplished by means of a band selector switch (S1) which switches the following functions:



BLOCK DIAGRAM OF I.F. AMPLIFIER (10.7 MC).

FIG 15

BLOCK DIAGRAM OF R.F. AMPLIFIER (200 - 400 MC)

FIG. 16

"B" Supply Voltage
Frequency Dial Illumination
I.F. Output
Gain

Since the 20 to 65 MC range has a high gain reserve, a potentiometer (R50) is provided in the cathode circuit of the first I.F. amplifier stage. This permits setting the gain to a value roughly corresponding to that of the 65 to 200 MC range.

The 10.7 MC I.F. amplifier (Block diagram Figure 15) consists of three amplifying stages and a cathode follower output stage. The output signal of the R.F. amplifier is switched into a low impedance line which feeds into the low impedance side of a line transformer. The high impedance circuit of this transformer is fed into the grid circuit of the first I.F. amplifier stage (6AK5). Its output, through a double tuned I.F. transformer, is applied to the grid circuit of the second I.F. amplifier (6BJ6). This stage is similarly coupled to the third I.F. amplifier (6BJ6). The third I.F. amplifier, through a single tuned I.F. output transformer, is fed to the grid of a triode connected 6BJ6 which is used as a cathode follower. This is done in order to feed the meter detector from a low impedance source to obtain good pulse response (see Par. 17). In order to obtain a high output voltage from the cathode follower stage, its cathode is tuned by means of L47.

The I.F. gain control R105, located on the main panel, varied the grid bias applied to the 1st, 2nd and 3rd I.F. amplifier stages.

15. Tuning Unit T-2/NF-105

Tuning Unit T-2/NF-105 covers the frequency range from 200 to 400 MC in one continuously tunable band.

The R.F. amplifier consists of a grounded grid R.F. amplifier stage, a local oscillator and a crystal mixer. A block diagram is shown in Fig. 16, detailed schematic illustration in Fig. 28.

The input signal is fed through a 50 ohm network, which, in conjunction with a tightly-coupled first tuned circuit keeps the input VSWR to a low value. The signal is inductively coupled to the tuned circuit which is fed into the cathode of a type 5876 pencil tube. The variable tuning elements used in this tuner are three individual tuning capacitors ganged together by means of a worm drive shaft. The R.F. stage operates as a grounded grid amplifier. Its plate circuit is tuned and inductively coupled to an untuned pick-up coil which feeds the signal to the 1N21B crystal mixer. The local oscillator operates at a frequency 30 MC

higher than the corresponding R.F. frequency. Its energy is fed inductively into the crystal pick-up coil. In the mixer, it is combined with the R.F. signal producing a difference frequency of 30 MC, which is the I.F. frequency. Since the crystal mixer produces an output signal at a low impedance, this signal is fed directly into a low impedance line.

The 30 MC I.F. amplifier consists of 4 amplifying stages and one cathode follower output stage. Its theory of operation follows closely that of the 10.7 MC I.F. amplifier (Par. 14) and is, therefore, not discussed in detail.

In order to avoid interference in reception by microphonics produced in the local oscillator, the entire R.F. amplifier chassis and its dial and tuning mechanism are shock mounted.

16. Tuning Unit T-3/NF-105

The frequency range of 400-1000 MC is divided into two bands, 400-700 MC and 700-1000 MC. The circuitry used in the two ranges is essentially identical except that the constants are adjusted to correspond to the proper frequencies. The circuit is shown in the schematic diagram for Tuning Unit T-3/NF-105, Figure 29. The tuned circuits used are capacity loaded quarter-wave coaxial lines in the R.F. circuits and capacity loaded half-wave parallel lines in the oscillator circuit. Frequency tuning is accomplished by varying the amount of capacity loading of the lines.

The input signal is applied to a coupled pair of tuned circuits preceding a grounded grid triode type 5876. The plate of the 5876 is tuned by means of a single tuned circuit which is inductively coupled to a crystal, type 1N21B. The local oscillator is also inductively coupled to this crystal mixer. In the 400-700 MC range a 6T4 is used as the local oscillator tube, while in the 700-1000 MC range a 6F4 tube is used. The local oscillator operates 42 megacycles above the fundamental frequency. The mixer output therefore produces an IF frequency of 42 MC.

The frequency range switch applies the mixer output of either the 400-700 MC or the 700-1000 MC tuner to the input of the IF amplifier. At the same time, it switches the "B" voltage and dial lights. The first stage of the IF amplifier uses a cascode circuit in order to provide a low noise figure. A 6BQ7A double triode is employed in this stage. It is followed by four stages of synchronously tuned pentodes type 6AK5 and a 6BJ6 in a cathode follower circuit.

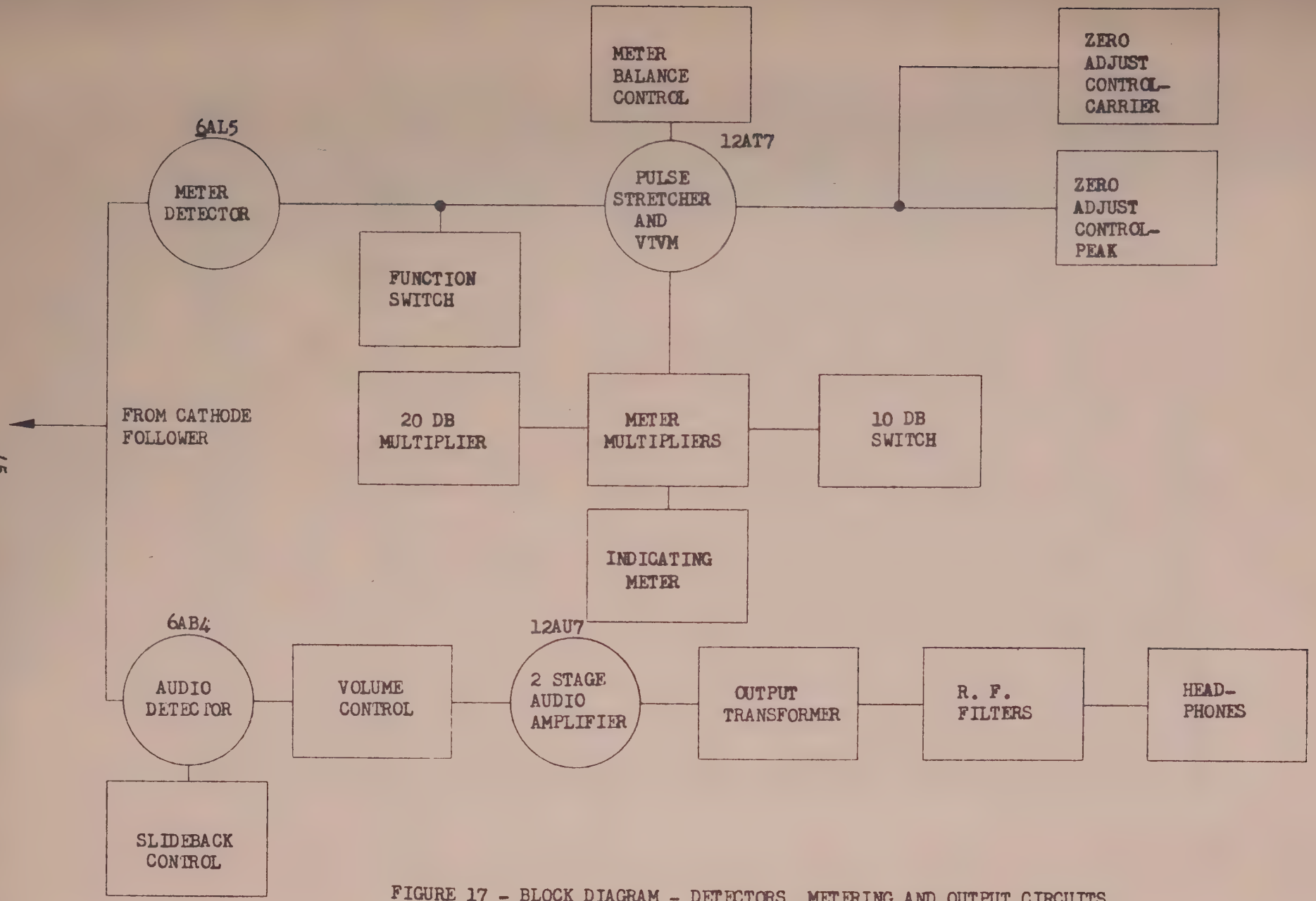


FIGURE 17 - BLOCK DIAGRAM - DETECTORS, METERING AND OUTPUT CIRCUITS

17. Detectors, Metering and Output Circuits

The output of the cathode followers (V7, V17 or V610) is applied to two detectors, V18 and V19, a 6AL5 and a 6AB4 respectively. The 6AL5, with both sections in parallel, supplies the voltage for the operation of the indicating meter; the 6AB4 operates as the audio detector. See Figure 17 for a block diagram, Figure 30 for a schematic diagram.

A function switch (S2) permits preliminary adjustment of the instrument and operates the meter circuits in two different manners. In the peak position, peak values of pulses or carriers are indicated; in the carrier position, peak of unmodulated carriers and average of modulated ones are read. Since it is difficult to show true peak values of pulses, especially at low repetition rates, special circuits are employed to accomplish satisfactory visual peak indication.

The output impedance of the cathode followers feeding the detectors is very low. Since the impedance of the two sections of the 6AL5 is also low, the resulting charge time is extremely short. The discharge time is made long by using a discharge resistor (R86) of 50 megohms. The discharge time is further increased by applying the 50 megohm resistor in the grid circuit of one-half of a double triode (V21) with negative feed back so that it operates as a resistance "magnifier" or a pulse stretcher, V21 simultaneously serves in the bridge type vacuum tube voltmeter circuit, which operates meter M1.

For carrier measurements, the 50 megohm resistor (R86) is shunted by R71 and R73 to a value of approximately 150,000 ohms. Thus, the discharge time is sufficiently shortened to permit indication of average rather than peak values.

For the 0 to 10 microvolt range, the voltage applied to the vacuum tube voltmeter for full scale reading is 2.5 volts. The corresponding voltage for the higher ranges is 25 volts. In both instances the R.F. and I.F. amplifiers are operated at the same gain level. The residual noise indication on the meter is thus reduced by a factor of 10 when operating on the higher ranges. The sensitivity of the instrument is switched by means of a wafer switch (S3) attached to the rear of the signal input attenuator. A momentary switch S4, located on the front panel, when operated shorts out part of the meter multiplier resistance, thus increasing the meter sensitivity by 10 DB. This feature effectively produces a 10 DB scale overlap and functions on all sensitivity ranges except the 0 to 10 microvolt range.

The indicating meter M1 is a 100 microampere logarithmic movement with one calibration serving the 0 to 10 microvolt range and a second one for all higher ranges. This distinction is necessary because of lack of linearity in the diode detector (V18) for voltages below 2.5 volts. The

meter movement is protected from overload by means of a 1N34 crystal (X2) when switched to the more sensitive range. The dynamic range of the I.F. amplifier limits the diode voltage to a safe value for the less sensitive range.

Certain preliminary adjustments are necessary in the vacuum tube voltmeter circuit in order to allow for variations in tubes, aging and warm-up. The function switch disables those circuits which would interfere with these adjustments.

The anode of the audio detector, with the function switch in the peak position, may be biased to any desired value from 0 to approximately -20 volts by means of the slideback control (R80). This permits clearer aural pulse reception and measurement of pulse amplitude by the slideback method. (See Par. 10.2) The audio detector is followed by a two stage audio amplifier using a dual triode type 12AU7 (V20). Its output is fed through transformer T10 and an RF filter network F3 to the phone jack on the front panel and to an AN connector for remote phone operation. The use of the RF filter network is necessary in order to filter out RF interference that may be picked up by the headset and to prevent any RF currents in the phone leads from coupling back to the input circuit.

In the "Meter Balance" position of the function switch, the grids of the two sections of V21 are grounded. The meter balance control (R90) may, therefore, be operated to compensate for differences in the two tube sections.

In the "Zero Adjust" position, the IF amplifier is disabled by being biased to cut-off; any voltage reaching the grid circuit of the vacuum tube voltmeter is generated in the meter detector (V18) as contact potential and may be balanced out by biasing the other section of the VTVM tube by an equivalent amount of voltage of like polarity. This is accomplished by zero adjust control R99 located on the front panel. This control balances out the contact potential appearing for the high diode load resistance in peak position.

In the carrier position, the amount of contact potential is somewhat lowered because of the lower load resistance. This potential is balanced out by the carrier zero potentiometer R101 located inside the equipment to the rear of the plug-in head.

18. Impulse Generator

The impulse generator serves as a standard impulse noise source producing extremely short pulses of variable repetition rate. Because of the short pulse duration (approximately 0.0005 microseconds) an impulse noise spectrum flat from 0.01 MC to 1000 MC is obtained.

BLOCK DIAGRAM OF IMPULSE GENERATOR

FIG. 19

BLOCK DIAGRAM OF SINE WAVE OSCILLATOR

FIG. 20

The impulse generator consists of an electronic repetition rate generator (V23), a pulse shaper (V25), a magnetic driver, a coaxial line, a metering system and a step attenuator. See block diagram Figure 19, schematic diagram Figure 30.

The repetition rate generator uses a 12AU7 (V23) in a multivibrator circuit. Its frequency of operation is adjustable from 2.5 cycles to 2500 cycles by means of switch S5 and dual potentiometer R122A and R122B. The signal is fed to another 12AU7 (V25), arranged as a cathode follower, which holds to a constant width the pulses used to operate the magnetic driver.

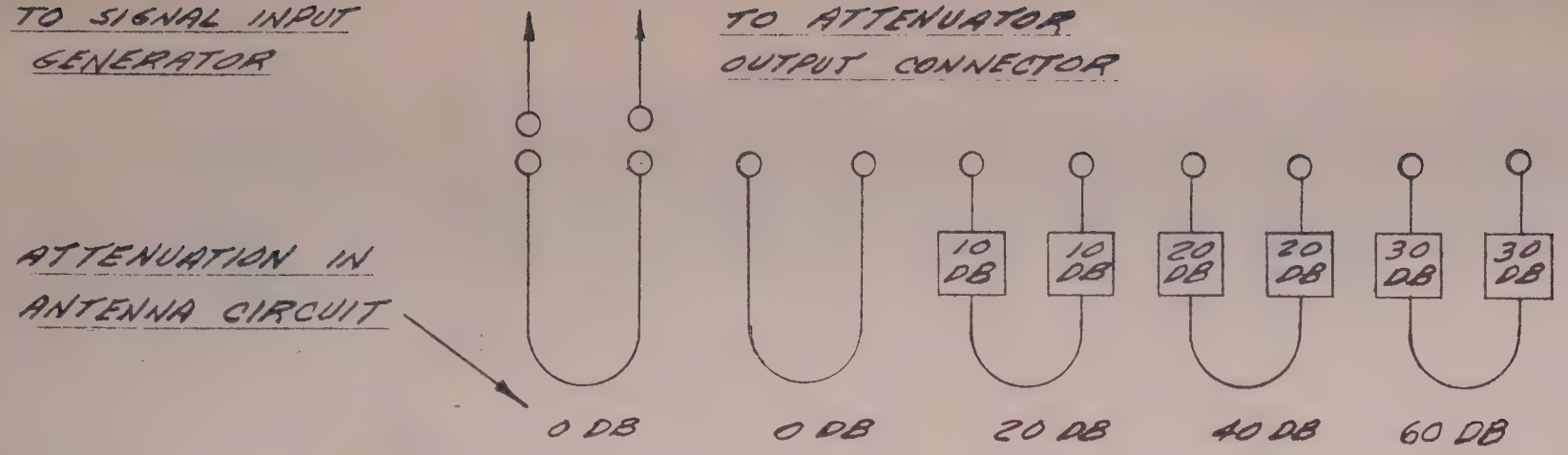
The device is coupled to a contact which discharges, at the desired pulse repetition rate, a charged coaxial line. The duration of the resultant pulse is determined by the length of the coaxial line. The polarity of the line charging voltage is reversed at 10 second intervals in order to minimize contact migration. Polarity reversal is accomplished by means of a 12AU7 (V24) multivibrator operating a relay (RE1).

Since the amplitude of the pulse generated in the coaxial line is, within the operating limits of the equipment, directly proportional to the charging voltage, the relative pulse amplitude in DB is shown by DC meter M3 as a function of the line charging voltage. The line charging voltage is varied over a 10 DB range by means of R163. Thus, a continuous 10 DB impulse output variation is achieved. The output may also be varied in steps of 10 DB by the impulse generator attenuator located on the front panel (see Par. 20). The total output in DB above one microvolt per megacycle of bandwidth is the sum of the indications of this meter and of the step attenuator.

The step attenuator is treated in Par. 20.

19. Sine Wave Oscillator

The sine wave oscillator (Figure 20) serves as a continuous wave calibrating standard delivering an output of 100,000 microvolts into a 50 ohm load. It operates at approximately 63 MC for calibration of the 20 to 200 MC R.F. plug-in head and at 215 MC for calibration of the 200 to 400 MC head. Frequency change is accomplished automatically by the head connector as plug-in heads are changed. The 63 MC oscillator uses one triode section of 12AT7 (V22), the 215 MC oscillator employing the other section. The output voltages of the 63 MC and the 215 MC oscillators are fed into low impedance links which, in turn, operate into a low impedance line. The oscillator level is preadjusted by varying the spacing between the tank coil and the coupling link. Fine adjustment is achieved by controlling the plate voltage of the oscillator



ATTENUATION IN VTVM CIRCUIT *	0 DB	20 DB	20 DB	20DB	20DB
TOTAL ATTENUATION (MARKED ON FRONT PANEL)	0 DB	20 DB	40 DB	60DB	80DB

BLOCK DIAGRAM OF SIGNAL INPUT ATTENUATOR.

FIG. 21

* THIS ATTENUATOR IS OPERATED BY A WAFER SWITCH, MOUNTED IN REAR OF THE ANTENNA INPUT ATTENUATOR

BLOCK DIAGRAM OF IMPULSE GENERATOR ATTENUATOR

FIG 22

tube by means of R118. The output of the sine wave oscillator is metered by the VTVM (see Par. 17). The contact potential is balanced by means of the oscillator zero control (R100). The oscillator unit employs double shielding and is thoroughly filtered in order to avoid radiation. The sine wave oscillator is shown in detailed schematic form in Figure 30.

20. Step Attenuators

The instrument utilizes two step attenuators, one of which is used in the signal input, the other in the impulse generator output circuit. In view of the high frequencies involved, the attenuators are coaxial networks, so designed that the resulting VSWR is kept to a low value. Each attenuator section is a resistive "T" pad in which the series elements consist of rod resistors, the shunt element being a disc type resistor. The diameter of the outer conductor is so calculated that with the rod resistors acting as inner conductors, a perfect 50 ohm line results at the beginning and the end of each network.

Block diagrams of the signal input and impulse generator attenuators are shown in Figures 21 and 22 respectively, a schematic diagram in Figure 30.

21. Power Supply

The power supply furnishes 150 volts "B" voltage, -150 volts "C" voltage, 300 volts charging voltage for the impulse generator, 250 volts for the P.R.R. generator and 6.3 volts "A" voltage. These voltages are regulated to make them independent of changes in either the primary supply voltage or in current drain in the various circuits due to changes in functional requirements.

Voltage regulation is accomplished by means of a vibrating finger regulator (RE2) which, using the 150 volts "B" voltage as reference, applies varying resistance values in series with the primary of the power transformer. The vibrating finger regulator and corresponding resistors are enclosed in a shield can in order to prevent relay contact noise from interfering with reception. All leads to this part of the circuit are well filtered.

The 150 volts "B" voltage is rectified by two 6X4 tubes (V29) and (V30) in a full wave circuit. The "C" voltage is derived from a 6X4 (V28) operating in a half wave circuit. Voltage regulation for the "C" circuit over and above that accomplished by the vibrating finger regulator is achieved by an 0A2 (V31) gas tube regulator. The charging voltage

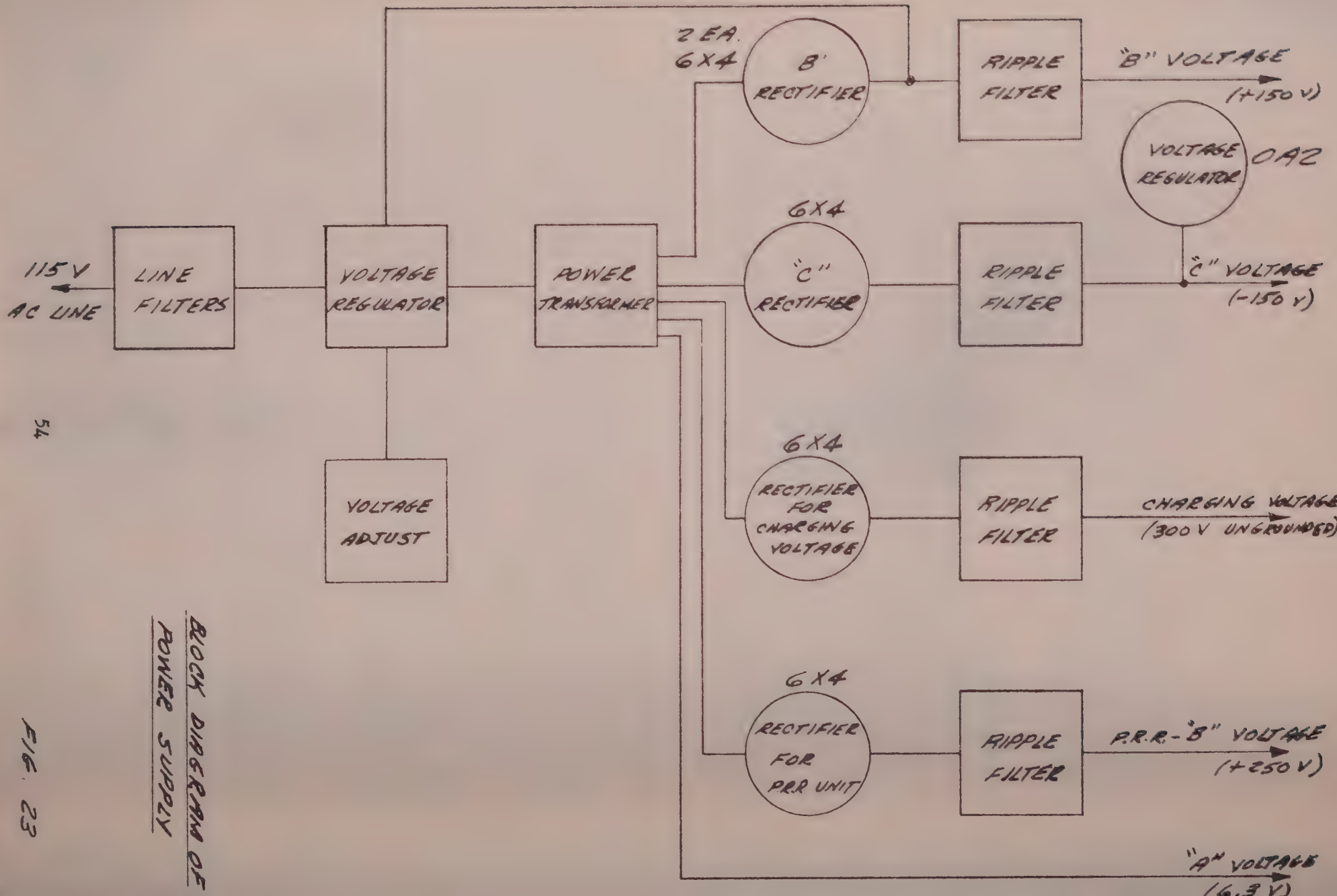


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FIG. 23

BLOCK DIAGRAM OF POWER SUPPLY

for the impulse generator is obtained from a 6X4 rectifier (V27) and the 250 volts "B" branch is rectified by another 6X4 (V26).

A block diagram of the power supply is shown in Figure 23, the schematic diagram in Figure 30.

22. Alignment Harness

In order to gain access to the various circuits and adjustments of the RF plug-in head during operation, an alignment harness is used.

The function of the harness is twofold. It powers the RF head and, at the same time, connects the IF output to the main unit. Since the IF amplifier would regenerate if a long output lead were employed for this connection, a germanium diode in conjunction with a load resistor and by-pass capacitor is built into that end of the harness which is closer to the plug-in head.

Since the alignment harness employs a simplified detector, it is intended for alignment purposes only. Therefore, quantitative measurements should not be taken when using this harness.

SECTION V

Alignment Procedures

NOTE: Before attempting to make any of the following adjustments, the equipment should be permitted to warm up for a period of not less than 15 minutes.

23. Tuning Unit T-1/NF-105

Remove the dust cover of the plug-in head and the shield cover of the R.F. chassis. In order to gain access to the adjustments for the I.F. and R.F. circuits, the use of alignment harness AH-105 is required. Connect the plug-in head to the main chassis by means of the harness.

23.1. I.F. Amplifier, 10.7 MC

Set the function switch to carrier position and the band switch on the plug-in head to the 20 to 65 MC range. The signal input attenuator must be kept in the 20 DB position for all of the following alignment procedures, unless otherwise specified. Feed a 10.7 MC signal from a signal generator to the mixer grid (pin 2 of V10) of the 20 to 65 MC range. Keep the signal generator and the I.F. gain control so adjusted that no overload occurs. Peak transformers T5, T7, T8 and T9 and coil L46 for maximum output, gradually decreasing the signal generator voltage to prevent overload.

Set the band switch on the plug-in head to the 65 to 200 MC range. Feed a 10.7 MC signal to pin 2 of V13. Peak T6, without disturbing the other adjustments made in the previous step.

Cathode coil L47 in the output stage of the I.F. amplifier is not to be adjusted during this operation.

23.2. R.F. Tuner, 20 - 65 MC

All R.F. adjustments must be made using an insulated screw driver with as small a metal tip as possible.

Set the band switch to 20 to 65 MC range. Feed an R.F. signal from the signal generator to antenna connector P7, which is the lower of the two connectors on the head panel. A 50 ohm unterminated line is to be used between the signal generator and the receiver. Connect the plug-in head to the main unit by means of the alignment harness.

With tuning control and signal generator set to 21 MC adjust oscillator trimmer C84 for maximum output and peak R.F. trimmers C60, C67 and C79. Set tuning control and signal generator to 62 MC. Do not attempt any alignment at this frequency if calibration and sensitivity appear to be satisfactory. If alignment is required, change inductance of oscillator end inductor L26, by squeezing or spreading turns. Follow by adjusting the R.F. end inductors L20, L22 and L24. Alternately repeat adjustments at 21 and 62 MC as required. Do not change the adjustment of oscillator shunt inductor L27 which governs the tracking across the band.

After the low frequency band has been completely aligned, check the available gain reserve at the weakest point in the calibrated band. With the signal input attenuator set to 20 DB and the I.F. gain control in its maximum clockwise position, approximately 50 microvolts should be required for full scale meter deflection. If the required input differs greatly from 50 microvolts, R50 located on the rear of the R.F. chassis, is adjusted until this requirement is fulfilled.

23.3. R.F. Tuner, 65 - 200 MC

Set the band switch to the 65 to 200 MC range. Feed an R.F. signal into the upper antenna connector (P10) on the panel of the plug-in head. Set tuning control and signal generator to 65 MC. Peak oscillator trimmer C117 and adjust R.F. trimmers C96, C101 and C109 for maximum output. Set tuning control and signal generator to 200 MC. If alignment is required, change the inductance of the oscillator end inductor L42 by squeezing or spreading turns. Follow by adjusting R.F. end inductors L33, L36 and L39.

Do not disturb shunt inductors L31, L34, L37 and L40 which govern the tracking across the band. Replace the entire unit in its dust cover.

Do not attempt to make the following adjustments using the alignment harness.

Remove the main unit from its dust cover and plug the 20 to 200 MC tuner into the main chassis. Set tuning control and signal generator to 20 MC. Turn the signal input attenuator to its 20 DB position and set the function switch to carrier. Place a 500 ohm resistor across the terminals of the main indicating meter, in order to extend its range. Increase the signal generator output until the receiver overload point is reached. Now adjust L47, the cathode follower coil on the I.F. chassis, for maximum output. Again increase the signal generator output until the overload point is reached and touch up L47. Tune L46 for maximum output and retouch L47. Remove the 500 ohm resistor from the meter terminals.

24. Tuning Unit T-2/NF-105

24.1. I.F. Amplifier, 30 MC

The procedures outlined in Par. 23.1 for the alignment of the 10.7 MC I.F. amplifier basically apply to the 30 MC I.F. amplifier as well.

Disconnect I.F. input connector P4 from the R.F. chassis adjacent to the worm gear drive. Feed a 30 MC signal into this connector. Align transformers T1, T2, T3 and coils L11, L62, carefully avoiding overload.

Cathode coil L16 is not be adjusted during this operation.

Reconnect the I.F. input plug to the R.F. unit and feed an R.F. signal of 200 MC into the antenna connector located on the front panel. Carefully tune the receiver for maximum meter deflection resulting from this signal. Peak C8 located beneath the R.F. chassis. Realign the I.F. input transformer T1 for maximum output with disturbing any of the other adjustments.

24.2. R.F. Tuner - 200 - 400 MC

Connect the 200 to 400 MC tuning unit to the main unit by means of the alignment harness. Feed the signal generator output, through the unterminated 50 ohm line into the antenna connector (P1) on the panel of the plug-in head. Set tuning control and signal generator to 395 MC. Adjust oscillator trimmer C12 for maximum output. Tune trimmer C20 while "rocking" the signal generator tuning until optimum alignment is obtained. Peak trimmers C1 and C2.

Set tuning control and signal generator to 210 MC. Adjust oscillator inductor L5 for maximum output.

NOTE: Great care must be exercised when adjusting oscillator or R.F. inductors for this frequency range, since very small changes in effective inductor length cause relatively large frequency changes.

Loosen the nut holding the oscillator inductor to the tuning capacitor (do not unsolder the other end of the inductor) and carefully slide the inductor until maximum output results. Retighten the nut. Repeat procedure until satisfactory alignment is obtained.

Adjust R.F. plate coil L3 by loosening both nuts holding it to the tuning capacitor and slide it until best alignment results. Retighten the nuts. At the same time note that L3 and L4 must be spaced approximately 1/8". The crystal mixer assembly is moved by sliding it after loosening its two mounting screws underneath the chassis. After proper coupling is obtained, retighten these screws. After changing the spacing, again check for proper inductance setting of L3.

In a similar manner, adjust L2. In this instance, a spacing of approximately 1/16" must exist between L1 and L2. This can be accomplished by bending L1 or sliding it after loosening its mounting screws.

If required, alternately repeat alignment at 395 MC and at 210 MC until optimum alignment results.

Do not attempt to make the following adjustments using the alignment harness. Remove the main unit from its dust cover and plug the 200 to 400 MC head into the main chassis. Set tuning control and signal generator to 200 MC. Set the signal input attenuator to its 20 DB position and the function switch to carrier. Place a 500 ohm resistor across the terminals of the main indicating meter in order to extend its range. Increase the signal generator output until the receiver overload point is reached. Now adjust L16, the cathode follower coil on the I.F. chassis, for maximum output. Again increase the signal generator output until the overload point is reached and touch up L16. Tune L11 for maximum output and retouch L16. Remove the 500 ohm resistor from the meter terminals.

25. Tuning Unit T-3/NF-105

25.1. I.F. Amplifier, 42 MC

The procedures outlined in par. 23.1 for the alignment of the 10.7 MC I.F. amplifier apply, basically, to the 42 MC I.F. amplifier as well.

Disconnect the I.F. connector P604. This is located next to the tuning adjustment for T601 on the small I.F. chassis at the rear of the frame. Feed a 42 MC signal into J604 on this chassis and align transformers T601, T602, T603, T604, T605, T606 and T607, being careful to avoid overload. Peak coil L635 under overload conditions as explained in par. 23.1.

Reconnect I.F. connector P604 to J604. Feed an RF signal of 400 MC into the 400-700 MC input connector on the front panel. Turn band-switch to the 400-700 MC position and adjust the TUNING control about the 400 MC mark for maximum output. Then readjust T601 for maximum output without disturbing any of the other adjustments.

25.2. R.F. Tuner, 400-700 MC

It must be kept in mind that the circuits in this tuning unit are very critical so that small changes in inductance or capacity will produce large changes in tuning, and thus in tracking and sensitivity. Therefore, it is important that no adjustments be made until it is determined that they are absolutely necessary and then these adjustments must be made with the utmost care.

Set the band switch to 400-700 MC. Feed an RF signal to input connector J605 which is the lower of the two connectors on the head panel. The signal generator should be isolated by a 50 ohm pad of at least 6 DB attenuation. Connect the plug-in head to the main unit by means of the alignment harness. With the signal input attenuator in the 20 DB position, and the IF GAIN control at maximum clockwise, set signal generator output to 100 microvolts. Tune receiver and generator to check points at approximately 50 MC intervals. If the meter indication is full scale or off scale at all check frequencies, the system gain is satisfactory.

Set signal input attenuator to 0 DB and signal generator output to 10 microvolts. At several check frequencies reduce IF GAIN until the signal generator output produces a full scale reading. Shut off the signal generator. The residual noise as indicated by the meter should not be in excess of 4 microvolts.

If the tuner so tested does not comply with the limits specified above proceed as follows. With the signal generator set at 420 MC adjust tuning control for maximum output. To align the RF and mixer circuits, bend their condenser plates for maximum signal indication.

After the low frequency end is aligned, set the signal generator at 670 MC and adjust tuning control for maximum output. The RF and mixer circuits may be peaked by adjusting the trimmer strips located under the tuning lines. Since this operation may disturb the low frequency adjustment, it is necessary to check both ends of the band several times to insure optimum performance.

After completing this alignment procedure, select the weakest point in the frequency range. Adjust L618 for maximum output.

25.3. R.F. Tuner, 700-1000 MC

This tuner is adjusted in the same manner as outlined in par. 25.2 for the 400-700 MC band. Use alignment frequencies of 730 and 960 MC. Also adjust L640 for maximum output.

26. Impulse Generator

If an impulse signal cannot be heard in the headset after the impulse generator has been adjusted, as outlined in Section III, Par. 10, proceed as follows:

a. Set IMPULSE GEN. FINE CONTACT ADJ. to the center of its range.

b. Turn IMPULSE GEN. CONTACT PRE-ADJ. clockwise as far as it will go. (The IMPULSE GEN. CONTACT PRE-ADJ. is a screw driver adjustment located above the coaxial connectors on the main front panel.) This increases the contact spacing to a maximum.

c. While listening to the receiver, with the aid of a screw driver slowly rotate the IMPULSE GEN. CONTACT PRE-ADJ. in a counter-clockwise direction until a signal is heard in the headset. Adjust this control for a clear tone.

d. For any further adjustment, rotate the IMPULSE GEN. FINE CONTACT ADJ. in either direction. For large changes in repetition rate, it may be necessary to retouch this adjustment for a clear tone in the receiver.

When not using the impulse generator, set the SINE WAVE OSC.-IMPULSE GEN. switch OFF. This will increase the contact life.

27. Repetition Rate Generator

Connect the output of the P.R.R. generator, accessible at the driving coil terminals of the impulse generator, to the vertical plates of an oscilloscope, whose horizontal plates are connected to a frequency calibrated audio generator. Set the impulse generator P.R.R. switch to its X100 position, the cycles control to 25. The frequency should now be 2500 cycles as checked by the audio generator. If an adjustment is required, set C187, accessible from the top of the P.R.R. driving unit, until the proper frequency output is obtained.

28. Sine Wave Oscillator

In order to check the sine wave oscillator output, proceed as follows. Plug the 20 to 200 MC Tuning Unit into the Basic Measuring Unit. Turn the sine wave oscillator on and use it as a source in accordance with instructions given in Section III, Operation. If the oscillator frequency should greatly vary from 63 MC, adjust trimmer capacitor C177 until this frequency is reached. C177 is accessible from the left side of the oscillator unit, as viewed from the front.

Connect the sine wave oscillator connector to the signal input connector on the main panel, through the 18" cable. Set the signal input attenuator to 80 DB, connect the attenuator output to the R.F. connector on the plug-in head by means of the six inch cable. With the function switch in the extreme counter-clockwise position, adjust the oscillator zero control for a zero reading on the meter (this adjustment must be made with the sine wave oscillator-impulse gen. switch in the off position). Turn on the sine wave oscillator, adjust the oscillator level control for full scale meter reading. Set the function switch to

carrier position. Tune the receiver about its "CAL" marking on the dial until the signal from the sine wave oscillator causes maximum deflection. Disconnect the 18" cable from the signal input connector. Feed to the signal input connector through a cable not to exceed two feet in length the output of an external standard signal generator tuned to the receiver frequency. Adjust the signal generator output to exactly 100,000 microvolts. Set the I.F. gain to produce full scale reading on the meter, carefully retuning the signal generator to ascertain that it is peaked to the receiver frequency. Do not change the setting of the I.F. gain control until the completion of the gain calibration. Disconnect the signal generator cable from the signal input connector and substitute the 18 inch cable which is still attached to the sine wave oscillator connector. Carefully peak the receiver to the sine wave oscillator frequency. The reading produced by the sine wave oscillator should be full scale. If it departs appreciably from full scale, adjust the oscillator level control for full scale reading while retuning the receiver to maximum meter deflection. Turn the function switch to its extreme counter-clockwise position. By means of control R247 (located on the main chassis behind the step attenuator controlling the impulse generator output) adjust the meter indication to full scale. Turn off the sine wave oscillator and readjust the oscillator zero control. Turn on the sine wave oscillator and readjust R247 for full scale reading. For greater accuracy alternately readjust the oscillator zero (oscillator off) and R247 (oscillator on).

Similarly adjust the high frequency sine wave oscillator at 215 MC using the 200 to 400 MC plug-in head. If the frequency should depart greatly from 215 MC, the inductance of L52 must be adjusted by squeezing or spreading turns. (No trimmer is available for this frequency). In order to gain access to L52, remove the outer shield of the sine wave oscillator unit as well as its rear plate. After all shields have been replaced, check and adjust the amplitude of the sine wave oscillator output as described for the 63 MC unit, adjusting R248 instead of R247.

29. Carrier Zero Adjustment

The meter zero adjustment for peak operation is accomplished by setting the zero adjust control as required in the instructions for operation. Should the zero adjust point in the carrier position (with I.F. gain control in extreme counter-clockwise position) differ from that on peak, proceed as follows:

After allowing the equipment to warm up, set the function switch to meter balance and adjust the meter balance control for meter zero. Turn the function switch to zero adjust and set the corresponding control for meter zero. Turn function switch to carrier and I.F.

gain to extreme counter-clockwise position. Set R101, located next to the audio output transformer, for meter zero.

30. Voltage Regulator

When changing the voltage regulator, it may be necessary to reset R170, located above the power transformer. With the line voltage adjusted to 115 volts, change the setting of R170 until the voltage on the filtered side of the main "B" supply circuit measures 150 volts.

31. Filament Voltage

The filament voltage for tubes V21 and V22 is dropped to 5.8 volts by means of semi-adjustable resistor, R149. R149 is located on the right side of the main chassis, near the front.

In order to adjust the filament voltage for V21 and V22, operate the equipment at a line voltage of 115 volts. Vary the position of the adjustable contact on the resistor, until the filament voltage becomes 5.8 volts.

SECTION VI

Repair Instructions

32. General

The procedures employed in repairing this equipment are largely conventional as far as the electronic circuits are concerned. It is the purpose of these instructions to point out unusual procedures that might be helpful in making repairs. Such instructions are considered desirable for maintenance of the following units.

a. Impulse Generator
b. Step Attenuators
c. Gear Trains
d. Relays
e. Pencil Tubes

33. Impulse Generator

The only parts in the impulse generator that may need replacement are contact #3010, contact #3011 and disc resistor #3012. If it is found that it is no longer possible to adjust the contacts, as outlined in Section V, 26, the following steps should be taken, always referring to Figure 24:

a. Remove the coaxial cable from the generator unit.
b. Disconnect the three wires at the rear of the generator.
c. Remove the four mounting screws and lift out the generator.
d. With wrench #3013 remove the center assembly of the coaxial output line.
e. With wrench #3014 remove the front contact from the inner end of the center conductor.
   NOTE: This also removes the disc resistor #3012 and a silver washer.
f. Examine the contact through a magnifying glass and, if it appears heavily pitted, replace it. If, however, it is only dirty, it may be cleaned with crocus cloth. Place the silver washer on the contact and screw it to the center conductor assembly.
   NOTE: Space contacts are furnished with each unit.
g. While holding drive rod locking nut with light pliers, remove the rear contact with wrench #3014, taking care not to distort the driving assembly.

h. In order to examine and clean or replace the rear contact, proceed as outlined for the front contact under step f.

ARRANGEMENT OF PARTS
IN IMPULSE GENERATOR

FIG. 24

i. Replace center conductor assembly.
j. Connect the three leads and coaxial cable to the generator unit.
k. Adjust contacts, as outlined in Section V, 26.

If there is reason to believe that the output level has changed, the disc resistor #3012 should be checked. It should be 10 ohms ±5% and should be replaced, if it has exceeded these tolerances.

In order to check this resistor, set the impulse generator output attenuator to 90 DB above 1 microvolt/MC and connect an ohmmeter between the center conductor and the shell of the impulse generator front panel connector. If the resistor must be replaced, proceed as shown in steps a. to f. above.

34. Step Attenuators

After it has been established that the attenuation value of one of the steps of either step attenuator varies from the nominal value (see Figures 21 and 22), the attenuator must be removed from the front panel, in order to be repaired.

The impulse generator output attenuator may be removed without loosening the main front panel. In order to remove the signal input attenuator, it is necessary to drop the front panel.

a. To take an attenuator apart, remove the three number 10 nuts attached to the rear of the three tie rods. Pull out the rear plate. The barrel is now loose; therefore, care must be taken not to drop it or its associated spring and washers.
b. Remove the barrel assembly.
c. Check the center pins for positioning. The point of each pin should be about flush with the face of its connector housing.
d. Loosen the number 6 nuts on the opposing end plate which lock the Allen set screws. Loosen each Allen set screw by approximately one turn.
e. Hold the barrel upright such that the plate in which the Allen set screws are located faces up. Remove the six number 6 screws used to fasten this plate. Remove the plate and the pressure slugs which are held down by the Allen set screws.
f. Identify the attenuator positions by referring to Figures 21 and 22 for the signal input and the impulse generator attenuator respectively. The 0 DB positions are the ones that have a coaxial line between the two connectors. Looking at the now opened end, the other positions are arranged clockwise for increasing attenuator for the impulse generator attenuator and counter-clockwise for the signal input attenuator.
g. In order to check the doubtful section, lift it out of the barrel. This is easily accomplished by pushing up on its

associated connectors. To remove a 10 DB section, first unsolder its connection to the coaxial cable, and swing the cable out of the way by pushing on its connector. If removing several sections at one time, note the location of each section so that it will be returned to its original position.

h. Check the resistance values of the suspected section(s) by referring to the following chart. The attenuator values are composed of 0, 10, 20, 25 or 30 DB sections or combinations thereof.

Attenuator Section	Series Resistors (rod)	Shunt Resistors (disc)
0 DB	-----	-----
10 DB	25.97	35.14
20 DB	40.91	10.10
25 DB	44.68	5.64
30 DB	46.93	3.17

The measured values must be within 2% of these nominal values.

i. After locating the defective resistor, make replacement.

j. Reassemble the attenuator in reverse order. Make certain of good alignment by checking connector fits. If binding should result,do not force. Instead, again go over the assembly operation.

35. Gear Trains

The gear trains, used in the tuning units, incorporate a clutch in order to prevent damage to the inductuners or the tuning capacitors respectively, should the tuning control inadvertently be turned past its end settings.

In the course of operation, this clutch may loosen up. It is to be reset as follows:

Remove the tuning head from its dust cover. Looking in from the side of the unit, a spring washer will be seen on the drive shaft. A collar controls the tension of this spring and thus the clutch action. If it becomes necessary to reset the clutch, loosen the two Allen set screws holding the collar to the shaft. With a screw driver move the collar toward the spring; gently pressing with the screw driver will increase the clutch tension. After the desired tension has been obtained, retighten the two Allen set screws.

36. Relays

a. There are two relays in Noise and Field Intensity Meter Model NF-105. One serves as a voltage regulator and is located in the voltage regulator box in the upper right hand corner of the equipment. Removing the cover of the voltage regulator box, pull out the relay and remove its dust cover. See that the small contact fingers are clean and are not bent out of shape. If one or several of these fingers have an oxidized surface, the relay was overloaded and should be replaced in order to assure continued satisfactory operation of the equipment. The other relay is used in the polarity reversing circuit of the impulse generator. It becomes accessible by removing the shield cover next to the three 12AU7 tubes on the P.R.R. unit.

b. Both relays should be carefully cleaned. Extreme care is required, especially in the case of the voltage regulator relay, because of its delicate contacts. The relays may be blown out with an air hose; however, the nozzle must be sufficiently far removed from the relay not to harm the mechanism. The contact located beneath the relay coil on the voltage regulator relay may be cleaned by means of sandpaper (0000), a crocus cloth, a small file or a relay burnishing tool. Whichever of the above tools is used, it must be gently applied in order not to mar the contact surface. Remove all loose dirt or metallic residue after cleaning relay contacts. The ten small finger contacts on the opposite side of the relay are too delicate for this type of cleaning and must not be touched. The polarity reversing relay must be cleaned in the same manner as the rear contact of the voltage regulator relay.

37. Pencil Tubes

Extreme care is required in removing and replacing the pencil tubes, type 5876 in T-2/NF-105 or T-3/NF-105. In order to remove this tube, from the T-2/NF-105 Tuning Unit, first remove the top of the vertical tube shield extending beyond the grid disc by pulling the shield straight up. Next, disconnect the two filament wires in the small compartment. Limit the heat which can reach the pencil tube by placing the jaws of a pair of long nose pliers between the solder connection and the tube and holding them there for at least 15 seconds after removing soldering iron. Remove the tube by gently pulling the grid disc straight up. Reverse procedure when replacing this tube.

To remove the 5876 pencil tube from either of the tuners in the T-3/NF-105 head, first remove the grid disc clamp. Disconnect the filament wires observing the precautions outlined in the previous paragraph. Lift the tube out of the clamps and then through the slotted hole in the shield plate. Reverse the procedure when replacing the tube.

PARTS LIST FOR

NOISE AND FIELD INTENSITY METER MODEL NF-105

For simplicity the designation of the main components in the following list is shown in abbreviated form; thus BA-105 is BA, T-1/NF-105 is T1, etc., see List of Components, Par. 4.

I. CAPACITORS

Ref. Symbol	Description	Part of
C1	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T2
C2	1.5-7 mmf, ceramic trimmer	"
C3	3-30 mmf, Hammarlund VU-30	"
C4	.5 mmf, 10%, 300 V, ceramic	"
C5	3-30 mmf, Hammarlund VU-30	"
C6	.47 mf, 20%, 400 V, metal tubular	Power Supply, BA
C7	180 mmf, 10%, 300 V, button mica	R.F. Tuner, T2
C8	3-12 mmf, ceramic trimmer	"
C9	100 mmf, 10%, 300 V, mica	"
C10	100 mmf, 10%, 300 V, button mica	"
C11	3-30 mmf, Hammarlund VU-30	"
C12	3-12 mmf, ceramic trimmer	"
C13	500 mmf, 10%, 300 V, button mica	"
C14	500 mmf, 10%, 300 V, button mica	"
C15	500 mmf, 10%, 300 V, button mica	"
C16	1000 mmf, 10%, 300 V, button mica	"
C17	500 mmf, 10%, 300 V, button mica	"
C18	500 mmf, 10%, 300 V, button mica	"
C19	1000 mmf, 10%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C20	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T2
C24	1000 mmf, 20%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C25	5000 mmf, 20%, 300 V, ceramic	"
C26	1000 mmf, 20%, 300 V, ceramic	"
C27	1000 mmf, 20%, 300 V, mica	R. F. Tuner, T1
C28	500 mmf, 10%, 300 V, button mica	30 MC I.F. Amplifier, T2
C29	50 mmf, 10%, 300 V, button mica	"
C30	50 mmf, 10%, 300 V, button mica	"
C31	1000 mmf, 20%, 300 V, ceramic	"
C32	1000 mmf, 20%, 300 V, ceramic	"
C33	1000 mmf, 20%, 300 V, ceramic	"
C34	500 mmf, 10%, 300 V, button mica	"
C35	500 mmf, 10%, 300 V, button mica	"
C38	5000 mmf, 20%, 300 V, ceramic	"
C39	1000 mmf, 20%, 300 V, ceramic	"
C40	500 mmf, 10%, 300 V, button mica	"
C41	500 mmf, 10%, 300 V, button mica	"
C43	1000 mmf, 20%, 300 V, ceramic	"
C44	5000 mmf, 20%, 300 V, ceramic	"
C45	1000 mmf, 20%, 300 V, ceramic	"
C46	500 mmf, 300 V, 10%, button mica	"
C47	500 mmf, 10%, 300 V, button mica	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C48	1000 mmf, 20%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C49	2000 mmf, 10%, 300 V, button mica	"
C50	500 mmf, 10%, 300 V, button mica	"
C51	1000 mmf, 20%, 300 V, ceramic	"
C52	500 mmf, 10%, 300 V, button mica	"
C53	500 mmf, 10%, 300 V, button mica	"
C54	500 mmf, 10%, 300 V, button mica	"
C55	500 mmf, 10%, 300 V, button mica	"
C57	5 mmf, 10%, 300 V, ceramic	R.F. Tuner, T1
C58	35 mmf, 5%, 300 V, ceramic	"
C59	35 mmf, 5%, 300 V, ceramic	"
C60	3-12 mmf, ceramic trimmer	"
C61	1000 mmf, 20%, 300 V, ceramic	"
C62	1000 mmf, 20%, 300 V, ceramic	"
C63	1000 mmf, 20%, 300 V, ceramic	"
C64	10,000 mmf, 20%, 300 V, ceramic	"
C65	35 mmf, 5%, 300 V, ceramic	"
C66	35 mmf, 5%, 300 V, ceramic	"
C67	3-12 mmf, ceramic trimmer	"
C68	82 mmf, 5%, silver mica	"
C69	1000 mmf, 20%, 300 V, ceramic	"
C70	1000 mmf, 20%, 300 V, ceramic	"
C71	1000 mmf, 20%, 300 V, ceramic	"
C72	10,000 mmf, 20%, 300 V, ceramic	"
C73	35 mmf, 5%, 300 V, ceramic	"
C74	35 mmf, 5%, 300 V, ceramic	"
C75	82 mmf, 5%, 300 V, silver mica	"
C76	500 mmf, 10%, 300 V, button mica	"
C77	100 mmf, 20%, 300 V, ceramic	"
C78	5 mmf, 10%, 300 V, ceramic	"
C79	3-12 mmf, ceramic trimmer	"
C80	1000 mmf, 20%, 300 V, ceramic	"
C81	25 mmf, 10%, 300 V, ceramic	"
C82	35 mmf, 5%, 300 V, ceramic	"
C83	15 mmf, 5%, 300 V, ceramic	"
C84	3-12 mmf, ceramic trimmer	"
C85	500 mmf, 10%, 300 V, button mica	"
C86	500 mmf, 10%, 300 V, button mica	"
C87	1000 mmf, 20%, 300 V, ceramic	"
C88	1000 mmf, 20%, 300 V, ceramic	"
C89	1000 mmf, 20%, 300 V, ceramic	"
C90	500 mmf, 10%, 300 V, button mica	"
C91	500 mmf, 10%, 300 V, button mica	"
C92	1000 mmf, 20%, 300 V, mica	"
C93	1000 mmf, 20%, 300 V, mica	"
C94	1000 mmf, 20%, 300 V, ceramic	"
C95	3 mmf, 10%, 300 V, ceramic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C96	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T1
C97	1000 mmf, 20%, 300 V, mica	"
C98	1000 mmf, 20%, 300 V, mica	"
C99	1000 mmf, 20%, 300 V, mica	"
C100	1000 mmf, 10%, 300 V, button mica	"
C101	1.5-7 mmf, ceramic trimmer	"
C102	5 mmf, 10%, 300 V, ceramic	"
C104	500 mmf, 10%, 300 V, button mica	"
C105	2 mmf, 20%, 300 V, ceramic	"
C106	1000 mmf, 20%, 300 V, mica	"
C107	1000 mmf, 20%, 300 V, mica	"
C108	1000 mmf, 10%, 300 V, button mica	"
C109	1.5-7 mmf, ceramic trimmer	"
C110	500 mmf, 10%, 300 V, button mica	"
C111	2 mmf, 5%, 300 V, ceramic	"
C113	1000 mmf, 20%, 300 V, ceramic	"
C114	1000 mmf, 10%, 300 V, button mica	"
C115	15 mmf, 5%, 300 V, ceramic	"
C116	5 mmf, 10%, 300 V, ceramic	"
C117	1.5-7 mmf, ceramic trimmer	"
C120	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C121	1000 mmf, 20%, 300 V, ceramic	"
C123	1000 mmf, 20%, 300 V, ceramic	"
C124	500 mmf, 10%, 300 V, button mica	"
C125	500 mmf, 300 V, 10%, button mica	"
C127	1000 mmf, 20%, 300 V, ceramic	"
C128	500 mmf, 10%, 300 V, button mica	"
C129	1000 mmf, 20%, 300 V, ceramic	"
C130	1000 mmf, 20%, 300 V, ceramic	"
C131	500 mmf, 10%, 300 V, button mica	R.F. Tuner, T1
C132	500 mmf, 10%, 300 V, button mica	"
C133	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C134	500 mmf, 10%, 300 V, button mica	"
C135	500 mmf, 10%, 300 V, button mica	"
C136	500 mmf, 10%, 300 V, button mica	"
C137	1000 mmf, 20%, 300 V, ceramic	"
C138	10,000 mmf, 20%, 300 V, ceramic	"
C139	10,000 mmf, 20%, 300 V, ceramic	R.F. Tuner, T1
C140	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C141	2000 mmf, 10%, 300 V, button mica	"
C142	1000 mmf, 20%, 300 V, ceramic	"
C143	500 mmf, 10%, 300 V, button mica	"
C144	500 mmf, 10%, 300 V, button mica	"
C145	10,000 mmf, 20%, 300 V, ceramic	"
C146	500 mmf, 10%, 300 V, button mica	"
C147	500 mmf, 10%, 300 V, button mica	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C148	500 mmf, 10%, 300 V, button mica	10.7 MC I.F. Amplifier, T1
C149	200 mmf, 5%, 300 V, silver mica	2nd Detector, BA
C150	200 mmf, 5%, 300 V, silver mica	"
C151	1000 mmf, 5%, 300 V, silver mica	"
C152	100 mmf, 5%, 300 V, silver mica	"
C153	100 mmf, 5%, 300 V, silver mica	"
C154	1000 mmf, 20%, 300 V, ceramic	VTVM, BA
C155	1000 mmf, 20%, 300 V, ceramic	"
C156	1000 mmf, 20%, 300 V, ceramic, stand off	2nd Detector, BA
C157	100 mmf, 20%, 300 V, ceramic, stand off	"
C158	0.5 mf, 20%, 600 V, oil filled	"
C159	10,000 mmf, 20%, 300 V, ceramic	"
C160	1000 mmf, 20%, 300 V, ceramic	Audio Amplifier, BA
C161	10,000 mmf, 20%, 300 V, ceramic	"
C162	250 mmf, 10%, 300 V, mica	"
C163	50 mf, 25 V, electrolytic	"
C164	10,000 mmf, 20%, 300 V, ceramic	"C" Bias, BA
C165	500 mmf, 10%, 300 V, button mica	Sine Wave Oscillator, BA
C166	500 mmf, 10%, 300 V, button mica	"
C167	2000 mmf, 10%, 300 V, button mica	"
C168	500 mmf, 10%, 300 V, button mica	"
C169	500 mmf, 10%, 300 V, button mica	"
C170	500 mmf, 10%, 300 V, button mica	"
C171	500 mmf, 10%, 300 V, button mica	"
C172	2000 mmf, 10%, 300 V, button mica	"
C173	500 mmf, 10%, 300 V, button mica	"
C174	500 mmf, 10%, 300 V, button mica	"
C175	500 mmf, 10%, 300 V, button mica	"
C176	500 mmf, 10%, 300 V, button mica	"
C177	3-12 mmf, ceramic trimmer	"
C178	50 mmf, 5%, 300 V, ceramic	"
C179	25 mmf, 5%, 300 V, ceramic	"
C180	15 mmf, 5%, 300 V, ceramic	"
C181	10 mmf, 5%, 300 V, ceramic	"
C182	15 mmf, 5%, 300 V, ceramic	"
C183	10,000 mmf, 300 V, mica } matched to	Impulse Generator, P.R.R., BA
C184	10,000 mmf, 300 V, mica } 20,000 mmf, 2%	"
C185	2000 mmf, 2%, 300 V, silver mica	"
C186	180 mmf, 2%, 300 V, silver mica	"
C187	4-30 mmf, ceramic trimmer	"
C188	10,000 mmf, 300 V, mica } matched to	"
C189	10,000 mmf, 300 V, mica } 20,000 mmf, 2%	"
C190	2000 mmf, 2%, 300 V, silver mica	"
C191	180 mmf, 2%, 300 V, silver mica	"
C192	10,000 mmf, 20%, GMV, ceramic	Power Supply, BA
C193	10,000 mmf, 20%, GMV, ceramic	"
C194	50 mf, 250 V, electrolytic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C195	35 mf, 400 V, electrolytic	Power Supply, BA
C196	35 mf, 400 V, electrolytic	"
C197	35 mf, 400 V, electrolytic	"
C198	35 mf, 400 V, electrolytic	"
C199	50 mf, 250 V, electrolytic	"
C200	50 mf, 250 V, electrolytic	"
C201	35 mf, 400 V, electrolytic	"
C202	35 mf, 400 V, electrolytic	"
C203	2 mf, 20%, 600 V, oil filled	Impulse Generator P.R.R., BA
C204	2 mf, 20%, 600 V, oil filled	"
C205	10,000 mmf, 20%, 300 V, ceramic	"
C206	100 mmf, 5%, 300 V, silver mica	Audio Detector, BA
C207	55 mmf, 10%, 300 V, ceramic	Impulse Generator, BA
C208	50 mmf, 10%, 300 V, ceramic	Audio Detector, BA
C209	10,000 mmf, 20%, 300 V, ceramic	Impulse Generator, BA
C210	1000 mmf, 20%, 300 V, ceramic	Meter Detector Filament, BA
C211	1000 mmf, 20%, 300 V, ceramic	VTVM Filament, BA
C212	1000 mmf, 20%, 2500 V, ceramic	Line Probe, 500 ohms, LH
C213	1000 mmf, 20%, 2500 V, ceramic	"
C214	1000 mmf, 20%, 2500 V, ceramic	"
C215	1000 mmf, 20%, 2500 V, ceramic	Line Probe, 50 ohms, LL
C216	1000 mmf, 20%, 2500 V, ceramic	"
C217	1000 mmf, 20%, 2500 V, ceramic	"
C218	500 mmf, 10%, 300 V, button mica	R.F. Tuner, T2
C219	1000 mmf, 20%, 300 V, ceramic	Impulse generator P.R.R.,BA
C220	1000 mmf, 20%, 300 V, ceramic	"
C221	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C222	500 mmf, 10%, 300 V, button mica	"
C223	5 mmf, 10%, 300 V, ceramic	Test Harness, AH
C224	1000 mmf, 20%, 300 V, ceramic	"
C601	3 mmf, 5%, 300 V, ceramic	R.F. Tuner, T3
C602	3 mmf, 5%, 300 V, ceramic	"
C603	500 mmf, GMV, 300 V, feed-thru ceramic	"
C604	500 mmf, GMV, 300 V, feed-thru ceramic	"
C605A	Tuning, Air	"
C605B	Tuning, Air	"
C605C	Tuning, Air	"
C605D	Tuning, Air	"
C606	20 mmf, 5%, 300 V, ceramic	"
C607	500 mmf, GMV, 300 V, feed-thru ceramic	"
C608	500 mmf, GMV, 300 V, feed-thru ceramic	"

. CAPACITORS continued

ef. Symbol	Description	Part of
C609	1 mmf, 500 V, ceramic	R.F. Tuner, T3
C610	500 mmf, GMV, 300 V, feed-thru ceramic	"
C611	500 mmf, GMV, 300 V, feed-thru ceramic	"
C612	3 mmf, 5%, 300 V, ceramic	"
C613	3 mmf, 5%, 300 V, ceramic	"
C614	500 mmf, GMV, 300 V, feed-thru ceramic	"
C615	500 mmf, GMV, 300 V, feed-thru ceramic	"
C616	500 mmf, GMV, 300 V, feed-thru ceramic	"
C617	500 mmf, GMV, 300 V, feed-thru ceramic	"
C618	20 mmf, 5%, 300 V, ceramic	"
C619	.68 mmf, 500 V, ceramic	"
C620	500 mmf, GMV, 300 V, ceramic feed-thru	"
C621	500 mmf, GMV, 300 V, feed-thru ceramic	"
C622	1000 mmf, 20%, 300 V, ceramic	42 MC Cascode, T3
C623	5 mmf, 5%, 300 V, ceramic	"
C624	1000 mmf, 20%, 300 V, ceramic	"
C625	1000 mmf, 20%, 300 V, ceramic	"
C626	500 mmf, 10%, 300 V, button mica	"
C627	1000 mmf, 20%, 300 V, ceramic	"
C633	1000 mmf, 20%, 300 V, ceramic	"
C635	500 mmf, 10%, 300 V, button mica	"
C636	500 mmf, 10%, 300 V, feed-thru button mica	"
C637	500 mmf, 10%, 300 V, button mica	"
C648	1000 mmf, 20%, 300 V, ceramic	42 MC I.F. Amplifier, T3
C649	1000 mmf, 10%, 300 V, button mica	"
C650	1000 mmf, 20%, 300 V, ceramic	"
C652	500 mmf, 10%, 300 V, button mica	"
C654	1000 mmf, 20%, 300 V, ceramic	"
C655	500 mmf, 10 %, 300 V, button mica	"
C656	1000 mmf, 10%, 300 V, button mica	"
C657	1000 mmf, 20%, 300 V, ceramic	"
C658	1000 mmf, 20%, 300 V, ceramic	"
C660	500 mmf, 10%, 300 V, button mica	"
C662	1000 mmf, 20%, 300 V, ceramic	"
C663	500 mmf, 10%, 300 V, button mica	"
C664	1000 mmf, 20%, 300 V, ceramic	"
C665	1000 mmf, 10%, 300 V, button mica	"
C666	1000 mmf, 20%, 300 V, ceramic	"
C668	500 mmf, 10%, 300 V, button mica	"
C669	1000 mmf, 20%, 300 V, ceramic	"
C672	1000 mmf, 20%, 300 V, ceramic	"
C673	1000 mmf, 10%, 300 V, button mica	"
C674	1000 mmf, 20%, 300 V, ceramic	"
C676	500 mmf, 10%, 300 V, button mica	"
C678	500 mmf, 10%, 300 V, button mica	"
C679	1000 mmf, 20%, 300 V, ceramic	"
C680	500 mmf, 10%, 300 V, button mica	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C681	.002 mf, 300 V, button mica	42 MC I.F. Amplifier, T3
C682	500 mmf, GMV, 300 V, feed-thru ceramic	"
C683	1000 mmf, 20%, 300 V, ceramic	"
C684	1000 mmf, 20%, 300 V, ceramic	"
C685	500 mmf, GMV, 300 V, feed-thru ceramic	"
C686	500 mmf, 10%, 300 V, button mica	"
C687	500 mmf, 10%, 300 V, button mica	"
C688	500 mmf, GMV, 300 V, feed-thru ceramic	"
C689	500 mmf, GMV, 300 V, feed-thru ceramic	"
C690	500 mmf, 10%, 300 V, feed-thru mica	Band Switch Box, T3
C691	500 mmf, 10%, 300 V, feed-thru mica	"
C692	500 mmf, 10%, 300 V, feed-thru mica	"
C693	500 mmf, 10%, 300 V, feed-thru mica	"
C694	500 mmf, 10%, 300 V, feed-thru mica	"
C695	500 mmf, 10%, 300 V, feed-thru mica	"
C696	5 mmf, 5%, 300 V, ceramic	R.F. Tuner, T3
C697	500 mmf, GMV, 300 V, feed-thru ceramic	"
C698	500 mmf, GMV, 300 V, feed-thru ceramic	"
C699A	Tuning, Air	"
C699B	Tuning, Air	"
C699C	Tuning, Air	"
C699D	Tuning, Air	"

II. FILTERS

Ref. Symbol	Description	Part of
F1, F2	Dual Filter, each section consisting of an iron core choke of #22 P.E. wire, by-passed by two .002 MFD, 300 V, capacitors	External Meter Circuit
F3	Filter consisting of an iron core choke of #24 P.E.wire, by-passed by two .002 MFD, 300 V, capacitors	Audio Output, BA
F4, F5	Dual Filter, each section consisting of an iron core choke of #20 P.E.wire, by-passed by two .002 MFD, 300 V, capacitors	Power Supply, BA
F6	Filter cartridge, consisting of an iron core choke of #20 P.E.wire, by-passed by two .002 MFD, 300 V, capacitors	Power Supply, BA
F7	Same as F6	Power Supply, BA
F8	Filter cartridge, consisting of an iron core choke of #22 P.E.wire, by-passed by two .002 MFD,300 V, capacitors	Power Supply, BA
F10	Filtron #FA485-24 V, #FA861-12V	Inverter, MO
F11	Filtron #FA486, 115 V	Inverter, MO

III. JACKS

Ref. Symbol	Description	Part of
J1	Phone Jack	Front Panel, BA
J2	Phone Jack	External Meter, BA
J601	UG290/U	R.F. Tuner, T3
J602	UG290/U	"
J603	UG290/U	"
J604	UG290/U	"
J605	IPC F-15D-B	"
J606	UG290/U	"
J607	UG535/U	"
J608	UG535/U	"

IV. INDUCTORS

Ref. Symbol	Description	Part of
L1	Antenna coupling	R.F. Tuner, T2
L2	Input tuning	"
L3	R.F. Plate	"
L4	Mixer pick-up	"
L5	Oscillator tank	"
L6A,B	Bifilar filament choke	"
L8	Filter choke	"
L9	Filter choke	"
L10	Filter choke	"
L11	Plate tuning	30 MC I.F. Amplifier, T2
L12	Filament choke	"
L13	Filament choke	"
L14	Filament choke	"
L15	Filament choke	"
L16	Cathode follower tuning	"
L17	Filament choke	R.F. Tuner, T2
L18	Filament choke	"
L19	Inductuner section	R.F. Tuner, T1
L20	End inductor	"
L21	Inductuner section	"
L22	End inductor	"
L23	Inductuner section	"
L24	End inductor	"
L25	Inductuner section	"
L26	End inductor	"
L27	Shunt inductor	"
L28	Filament choke	"
L30	Filament choke	"
L31	Shunt inductor	"
L32	Inductuner section	"
L33	End inductor	"
L34	Shunt inductor	"
L35	Inductuner section	"
L36	End inductor	"
L37	Shunt inductor	"
L38	Inductuner section	"
L39	End inductor	"
L40	Shunt inductor	"
L41	Inductuner section	"
L42	End inductor	"
L43	Filament choke	"
L45	Filament choke	"
L46	I.F. Plate tuning inductor	10.7 MC I.F. Amplifier, T1
L47	Cathode tuning inductor	"
L48	Filament choke	"
L49	Filament choke	"
L50	Filament choke	"

IV. INDUCTORS continued

Ref. Symbol	Description	Part of
L51	63 MC oscillator tank	Sine wave oscillator, BA
L52	215 MC oscillator tank	"
L53	63 MC pick-up coil	"
L54	215 MC pick-up coil	"
L55	Filament choke	"
L56	Filament choke	"
L57	Filament choke	"
L58	Driving coil assembly	Impulse Generator, BA
L59A,B	Dual filter choke	Power Supply, BA
L60	Choke, 3T, $\frac{1}{4}$ Dia.	R.F. Tuner, T2
L61	Filament choke	"
L62	Plate tuning	30 MC I.F. Amplifier, T2
L63	Filament choke	"
L64	Filament choke	Sine Wave Oscillator, BA
L65	Filament choke	"
L66	Iron core choke of #22 P.E. wire	"
L601	Cathode choke	R.F. Tuner, T3
L602	Plate choke	"
L603	Plate choke	"
L604	Filament choke	"
L605	Filament choke	"
L606	Filament choke	"
L608	Cathode choke	"
L609	Cathode choke	"
L610	Plate choke	"
L611	Plate choke	"
L612	Filament choke	"
L613	Filament choke	"
L614	Filament choke	"
L615	Filament choke	"
L617	Cathode choke	"
L618	Mixer coil	"
L619	Neutralizing coil	42 MC Cascode, T3
L620	Cathode Choke	"
L621A	Filament choke	"
L621B	Filament choke	"
L623	Filament choke	"
L624	B/ choke	"
L625	Filament choke	"
L626	B/ choke	R.F. Tuner, T3
L627	Filament choke	"

IV. INDUCTORS continued

Ref. Symbol	Description	Part of
L628	Filament choke	42 MC I.F. Amplifier, T3
L629	Filament choke	"
L630	Filament choke	"
L632	Filament choke	"
L633	Filament choke	"
L635	Cathode coil	"
L640	Mixer coil	R.F. Tuner, T3
L642	Filament choke	"
L643	Filament choke	"

V. PILOT LIGHTS

Ref. Symbol	Description	Part of
LP1	Lamp No. 47	R.F. Tuner, T2
LP2	Lamp No. 47	R.F. Tuner, T1
LP3	Lamp No. 47	"
LP4	Lamp No. 47	Pilot Light, BA
LP601	Lamp No. 47	R.F. Tuner, T3
LP602	Lamp No. 47	"

VI. METERS

Ref. Symbol	Description	Part of
M1	4.5" meter, 100 uA movement	Internal Meter, BA
M2	4.5" meter, 100 uA movement	External Meter, RE
M3	1.5" meter, 1 ma movement	DB Meter, BA

VII. INVERTER

Ref. Symbol	Description	Part of
MC1	DC Inverter, 115 V, 60 cycles output MC12-105 - 12 V DC input or MC24-105 - 24 V DC input	Inverter Unit, MC

VIII. CONNECTORS

Ref. Symbol	Description	Part of
P1	UG-291/U	R.F. Tuner, T2
P2	UG-88/U	"
P3	UG-291/U	"
P4	UG-88/U	30 MC I.F.Amplifier, T2
P5	IPC #2175	"
P6	IPC #F-15-D-B	R.F. Tuner, T2
P7	UG-291/U	R.F. Tuner, T1
P8	UG-88/U	"
P9	UG-291/U	"
P10	UG-291/U	"
P11	UG-88/U	"
P12	UG-291/U	"
P13	IPC #2175	"
P14	IPC #F-15-D-B	"
P15	IPC #2225	2nd Detectors, BA
P16	IPC #M-15-D-A	R.F. Head Power Conn.,BA
P17	AN-3102-14S-2S (external meter)	Front Panel, BA
P18	AN-3106-14S-2P	Meter Cable, BA
P19	AN-3106-14S-2S	"
P20	AN-3102-14S-2P	External Meter, RE
P21	AN-3102-14S-1P	Power Supply, BA
P22	AN-3106-14S-1S	AC Power Cable, BA
P23	Hubbel #9754	"
P24	Amphenol #61-MIP-61F	Inverter Unit, MC
P25	AN-3102-16-11P	"
P26	AN-3106-16-11S	DC Power Cable, DC
P27	UG-290/U	Sine Wave Oscillator, BA
P28	UG-88/U	"
P29	UG-291/U	"
P30	Special, Type N	Impulse Gen. Attenuator, BA
P31	MS-2012	"
P32	UG-291/U	"

VIII.CONNECTORS continued

Ref. Symbol	Description	Part of
P33	UG-90/U mod. Part #2031	Impulse Gen. Attenuator, BA
P34	UG-90/U mod.fPart #2031	"
P35	Part #2021	"
P36	Part #2021	"
P37	Part #2021	"
P38	Part #2030D	"
P39	Part #2030D	"
P40	Part #2030D	"
P41	Part #2030D	"
P42	Part #2030D	"
P43	Part #2030D	"
P44	Part #2030D	"
P45	UG-291/U	Signal Attenuator, BA
P46	UG-90/U mod. Part #2031	"
P47	UG-291/U	"
P48	UG-90/U mod. Part #2031	"
P49	UG-88/U	R.F. Patch Cord, BA
P50	UG-88/U	"
P51	Part #2021	Signal Attenuator, BA
P52	Part #2021	"
P53	Part #2021	"
P54	Part #2021	"
P55	Part #2030D	"
P56	Part #2030D	"
P57	Part #2030D	"
P58	Part #2030D	"
P59	Part #2030D	"
P60	Part #2030D	"
P64	MS-2003	Injection Block, UN
P65	UG-290/U	"
P66	UG-89/U	"
P67	UG-23/U	Broad Band Antenna, BB
P68	UG-625/U	Magnetic Probe, MP
P69	UG-290/U	50 ohm Line Probe, LL
P70	UG-290/U	500 ohm Line Probe, LH
P71	UG-625/U	Electric Field Probe, EP
P72	UG-625/U	Dipole Antenna, DM
P73	UG-291/U	R.F. Tuner, T2
P74	UG-88/U	R.F. Cable, CB
P75	UG-88/U	R.F. Cable, CB
P76	UG-88/U	"
P77	UG-88/U	"
P78	Cinch #14K11613	R.F. Tuner, T1
P79	Cinch #13269	"
P80	IPC #2175	Test Harness, AH

VIII. CONNECTORS continued

Ref. Symbol	Description	Part of
P81	IPC #F-15-D-B	Test Harness, AH
P82	IPC #2225	"
P83	IPC #M-15-D-A	"
P84	Part #2030D	Impulse Gen. Attenuator, BA
P85	Part #2030D	"
P601	UG-88/U	R.F. Tuner, T3
P602	UG-88/U	"
P603	UG-88/U	42 MC Cascode, T3
P604	UG-88/U	"
P605	UG-88/U	42"MC I.F. Amplifier, T3
P606	UG-88/U	"
P607	UG-88/U	R.F. Tuner, T3
P608	UG-88/U	"

IX. RESISTORS

Ref. Symbol	Description	Part of
R1	62 ohms, 5%, disc resistor, Part #D343	R.F. Tuner, T2
R2	160 ohms, 10%, ½W, carbon	"
R4	47 ohms, 10%, ½W, carbon	"
R6	470 ohms, 10%, ½W, carbon	"
R7	100K ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R8	47 ohms, 10%, ½W, carbon	"
R9	100 ohms, 10%, ½W, carbon	R.F. Tuner, T2
R10	47 ohms, 10%, ½W, carbon	"
R11	20K ohms, 10%, 10W, wire wound	"
R12	10K ohms, 10%, ½W, carbon	"
R13	220 ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R14	2.7K ohms, 10%, ½W, carbon	"
R15	330K ohms, 10%, ½W, carbon	"
R16	100 ohms, 10%, ½W, carbon	"
R17	150 ohms, 10%, ½W, carbon	"
R18	2.7K ohms, 10%, ½W, carbon	"
R19	47K ohms, 10%, ½W, carbon	"
R20	330K ohms, 10%, ½W, carbon	"
R21	220 ohms, 10%, ½W, carbon	"
R22	150 ohms, 10%, ½W, carbon	"
R23	2.7K ohms, 10%, ½W, carbon	"
R24	150 ohms, 10%, ½W, carbon	"
R25	220 ohms, 10%, ½W, carbon	"
R26	150 ohms, 10%, ½W, carbon	"
R27	270 ohms, 10%, ½W, carbon	"
R28	100K ohms, 10%, ½W, carbon	"
R29	220 ohms, 10%, ½W, carbon	"
R31	150 ohms, 10%, ½W, carbon	"
R32	220 ohms, 10%, ½W, carbon	R.F. Tuner, T1
R33	47 ohms, 5%, ½W, carbon	"
R34	27K ohms, 10%, ½W, carbon	"
R35	220 ohms, 10%, ½W, carbon	"
R36	2.7K ohms, 10%, ½W, carbon	"
R37	27K ohms, 10%, ½W, carbon	"
R38	390 ohms, 10%, ½W, carbon	"
R39	27K ohms, 10%, ½W, carbon	"
R40	100 ohms, 10%, ½W, carbon	"
R41	2.7K ohms, 10%, ½W, carbon	"
R42	100 ohms, 10%, ½W, carbon	"
R43	27K ohms, 10%, ½W, carbon	"
R44	150 ohms, 10%, ½W, carbon	"
R45	47 ohms, 10%, ½W, carbon	"
R46	1K ohms, 10%, ½W, carbon	"
R47	10K ohms, 10%, ½W, carbon	"
R48	5.6K ohms, 10%, 2W, carbon	"
R50	5K ohms, potentiometer	"
R51	220 ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R52	50 ohms, 5%, ½W, disc-type D343	R.F. Tuner, T1
R53	47K ohms, 10%, ½W, carbon	"
R54	220 ohms, 10%, ½W, carbon	"
R55	100 ohms, 10%, ½W, carbon	"
R57	100 ohms, 10%, ½W, carbon	"
R58	27K ohms, 10%, ½W, carbon	"
R59	220 ohms, 10%, ½W, carbon	"
R60	22K ohms, 10%, ½W, carbon	"
R61	100 ohms, 10%, ½W, carbon	"
R62	47 ohms, 10%, ½W, carbon	"
R63	100 ohms, 10%, ½W, carbon	"
R64	27K ohms, 10%, ½W, carbon	"
R65	10K ohms, 10%, ½W, carbon	"
R66	22K ohms, 10%, ½W, carbon	"
R67	10K ohms, 10%, ½W, carbon	"
R69	5.6K ohms, 10%, 2W, carbon	"
R70	150 ohms, 10%, ½W, carbon	"
R71	100K ohms, 10%, ½W, carbon	Meter Detector, BA
R72	220K ohms, 10%, ½W, carbon	"
R73	47K ohms, 10%, ½W, carbon	"
R74	220K ohms, 10%, ½W, carbon	"
R75	2.2M ohms, 10%, ½W, carbon	Sine Wave Oscillator, BA
R76	220K ohms, 10%, ½W, carbon	Audio Detector, BA
R77	22K ohms, 10%, ½W, carbon	"
R78	47K ohms, 10%, ½W, carbon	"
R79	22K ohms, 10%, ½W, carbon	"
R80	50K ohms, potentiometer	Slideback, BA
R81	25K ohms, potentiometer	Volume, BA
R82	100K ohms, 10%, ½W, carbon	Audio Amplifier, BA
R83	1K ohms, 10%, ½W, carbon	"
R84	470K ohms, 10%, ½W, carbon	"
R85	270 ohms, 10%, ½W, carbon	"
R86	50M ohms, 1%, 1W, precision	VTVM, BA
R87	1K ohms, 10%, ½W, carbon	"
R88	390 ohms, 10%, ½W, carbon	"
R89	47K ohms, 10%, 2W, carbon	"
R90	10K ohms, potentiometer	Meter Balance, BA
R91	1K ohms, 10%, ½W, carbon	VTVM, BA
R92	47K ohms, 10%, 2W, carbon	"
R93	1K ohms, 10%, ½W, carbon	"
R94	6K ohms, 1%, ½W, precision	"
R95	22.3K ohms, 1%, ½W, precision	"
R96	54K ohms, 1%, ½W, precision	"
R97	166K ohms, 1%, ½W, precision	"
R98	150K ohms, 10%, ½W, carbon	"
R99	2.5K ohms, potentiometer	Zero Adjust, BA

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R100	10K ohms, potentiometer	Oscillator Zero, BA
R101	10K ohms, potentiometer	Carrier Zero, BA
R102	47K ohms, 10%, 2W, carbon	Sine Wave Oscillator, BA
R103	330K ohms, 10%, ½W, carbon	VTVM, BA
R104	220K ohms, 10%, ½W, carbon	Gain Control Circuit, BA
R105	25K ohms, potentiometer	"
R106	100K ohms, 10%, ½W, carbon	"
R107	220K ohms, 10%, ½W, carbon	Sine Wave Oscillator, BA
R108	220K ohms, 10%, ½W, carbon	"
R109	680 ohms, 10%, ½W, carbon	"
R110	2.7K ohms, 10%, 2W, carbon	"
R111	680 ohms, 10%, ½W, carbon	"
R112	2.7K ohms, 2W, carbon, 10%	"
R113	220K ohms, 10%, ½W, carbon	"
R114	220K ohms, 10%, ½W, carbon	"
R115	2.2M ohms, 10%, ½W, carbon	"
R116	10K ohms, 10%, ½W, carbon	"
R117	22K ohms, 10%, ½W, carbon	"
R118	10K ohms, potentiometer	Oscillator Level, BA
R119	47K ohms, 10%, 2W, carbon	Sine Wave Oscillator, BA
R120	47K ohms, 10%, 2W, carbon	"
R121	430K ohms, 5%, ½W, carbon	Impulse Generator P.R.R.,BA
R122A,B	5M ohms, dual potentiometer	"
R123	47K ohms, 10%, ½W, carbon	"
R124	47K ohms, 10%, ½W, carbon	"
R125	430K ohms, 5%, ½W, carbon	"
R127	10K ohms, 10%, 1W, carbon	"
R128	4.7M ohms, 10%, ½W, carbon	"
R129	3.3K ohms, 10%, 1W, carbon	"
R130	4.7M ohms, 10%, ½W, carbon	"
R132	2.2M ohms, 10%, ½W, carbon	"
R133	1M ohms, 10%, ½W, carbon	"
R135	470 ohms, 10%, ½W, carbon	"
R136	10K ohms, 10%, 2W, carbon	"
R137	10K ohms, 10%, 2W, carbon	"
R138	20K ohms, potentiometer	Fine Contact Adjustment, BA
R139	10K ohms, 10%, 2W, carbon	Impulse Generator P.R.R.,BA
R140	10K ohms, 10%, 2W, carbon	"
R143	1M ohms, 10%, ½W, carbon	"
R144	2.2M ohms, 10%, ½W, carbon	"
R145	470 ohms, 10%, ½W, carbon	"
R146	10 ohms, 10%, ½W, disc - type D490	Impulse Generator, BA
R147	4.7M ohms, 10%, ½W, carbon	"
R149	2 ohms, 10%, WW, semi-variable, 10W	Power Supply, BA
R150	1.2K ohms, 10%, 1W, carbon	"
R152	1K ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R153	100 ohms, 10%, ½W, carbon	Power Supply, BA
R154	47 ohms, 10%, ½W, carbon	Audio Amplifier, BA
R155	2.2K ohms, 10%, 2W, Carbon (2 ea.in par.)	Power Supply, BA
R156	1.2K ohms, 10%, 1W, carbon	"
R157	2.2K ohms, 10%, 2W, carbon	"
R158	100 ohms, 10%, ½W, carbon	"
R159	4.7K ohms, 10%, ½W, carbon	"
R160	10K ohms, 10%, 25W, wire wound	"
R161	390K ohms, 10%, 1W, carbon	"
R162	10K ohms, 10%, ½W, carbon	Impulse Generator, BA
R163	100K ohms, potentiometer	Add to Imp.Gen.Output, BA
R164	300K ohms, 1%, 1W, Prec. resistor	Impulse Generator, BA
R168	15K ohms, 5%, compensating	Voltage Regulator, BA
R169	7.5Kohms, 10%, 2W, carbon	"
R170	5K ohms, potentiometer	VR Adjust, BA
R171	150 ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R172	1K ohms, 10%, ½W, carbon	R.F. Tuner, T1
R173	100 ohms, 10%, ½W, carbon	10.7 MC I.F. Amplifier, T1
R174	2.7K ohms, 10%, ½W, carbon	"
R175	150 ohms, 10%, ½W, carbon	"
R176	330K ohms, 10%, ½W, carbon	"
R177	47K ohms, 10%, ½W, carbon	"
R178	100 ohms, 10%, ½W, carbon	"
R179	2.7K ohms, 10%, ½W, carbon	"
R180	330K ohms, 10%, ½W, carbon	"
R181	150 ohms, 10%, ½W, carbon	"
R182	100 ohms, 10%, ½W, carbon	"
R183	2.7K ohms, 10%, ½W, carbon	"
R184	100K ohms, 10%, ½W, carbon	"
R185	220 ohms, 10%, ½W, carbon	"
R186	150 ohms, 10%, ½W, carbon	"
R187	150 ohms, 10%, ½W, carbon	"
R188	150 ohms, 10%, ½W, carbon	"
R189	25.96 ohms, 2%, ½W, RPC type FAC	Signal Attenuator, BA
R190	35.14 ohms, 1%, ½W, disc type D343	"
R191	25.96 ohms, 2%, ½W, RPC type FAC	"
R192	25.96 ohms, 2%, ½W, RPC type FAC	"
R193	35.14 ohms, 1%, ½W, disc type D343	"
R194	25.96 ohms, 2%, ½W, RPC type FAC	"
R195	40.91 ohms, 2%, ½W, RPC type FAC	"
R196	10.1 ohms, 1%, ½W, disc type D343	"
R197	40.91 ohms, 2%, ½W, RPC type FAC	"
R198	40.91 ohms, 2%, ½W, RPC type FAC	"
R199	10.1 ohms, 1%, ½W, disc type D343	"
R200	40.91 ohms, 2%, ½W, RPC type FAC	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R201	46.93 ohms, 2%, ½W, RPC type FAC	Signal Attenuator, BA
R202	3.17 ohms, 1%, ½W, disc type D343	"
R203	46.93 ohms, 2%, ½W, RPC type FAC	"
R204	46.93 ohms, 2%, ½W, RPC type FAC	"
R205	3.17 ohms, 1%, ½W, disc type D343	"
R206	46.93 ohms, 2%, ½W, RPC type FAC	"
R207	25.96 ohms, 2%, ½W, RPC type FAC	Impulse Gen. Attenuator, BA
R208	35.14 ohms, 1%, ½W, disc type D343	"
R209	25.96 ohms, 2%, ½W, RPC type FAC	"
R210	25.96 ohms, 2%, ½W, RPC type FAC	"
R211	35.14 ohms, 1%, ½W, disc type D343	"
R212	25.96 ohms, 2%, ½W, RPC type FAC	"
R213	25.96 ohms, 2%, ½W, RPC type FAC	"
R214	35.14 ohms, 1%, ½W, disc type D343	"
R215	25.96 ohms, 2%, ½W, RPC type FAC	"
R216	25.96 ohms, 2%, ½W, RPC type FAC	"
R217	35.14 ohms, 1%, ½W, disc type D343	"
R218	25.96 ohms, 2%, ½W, RPC type FAC	"
R219	40.91 ohms, 2%, ½W, RPC type FAC	"
R220	10.1 ohms, 1%, ½W, disc type D343	"
R221	40.91 ohms, 2%, ½W, RPC type FAC	"
R223	10.1 ohms, 1%, ½W, disc type D343	"
R224	40.91 ohms, 2%, ½W, RPC type FAC	"
R225	40.91 ohms, 2%, ½W, RPC type FAC	"
R226	10.1 ohms, 1%, ½W, disc type D343	"
R227	40.91 ohms, 2%, ½W, RPC type FAC	"
R228	50 ohms, 5%, ½W, carbon	Line Probe, LH
R229	450 ohms, 5%, ½W, carbon	"
R230	500 ohms, 5%, ½W, carbon	"
R231	45.0 ohms, 2%, ½W, RPC type FAC	Injection Block, UN
R232	5 ohms, 1%, ½W, disc type D343	"
R233	45.0 ohms, 2%, ½W, RPC type FAC	"
R234	45.0 ohms, 2%, ½W, RPC type FAC	"
R235	5 ohms, 1%, ½W, disc type D343	"
R236	44.68 ohms, 2%, ½W, RPC type FAC	Impulse Gen. Attenuator, BA
R237	5.64 ohms, 1%, ½W, disc type D343	"
R238	44.68 ohms, 2%, ½W, RPC type FAC	"
R239	56 ohms, 10%, 2W, carbon	Power Supply, BA
R240	1M ohms, 10%, ½W, carbon	10.7 MC I.F. Amplifier, T1
R241	220K ohms, 10%, ½W, carbon	"
R242	100K ohms, 10%, ½W, carbon	"
R243	100K ohms, 10%, ½W, carbon	"
R244	2700 ohms, 10%, ½W, carbon	R.F. Tuner, T1
R245	2700 ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R246	100K ohms, 10%, ½W, carbon	Test Harness, AH
R247	2.5 Megohms, potentiometer	Sine Wave Oscillator, BA
R248	2.5 Megohms, potentiometer	"
R249	44.68 ohms, 2%, ½W, RPC type FAC	Impulse Gen. Attenuator, BA
R250	5.64 ohms, 1%, disc type D343	"
R251	44.68 ohms, 2%, ½W, RPC type FAC	"
R252	40.91 ohms, 2%, ½W, RPC type FAC	"
R253	15K ohms, 10%, ½W, carbon	Impulse Generator P.R.R.,BA
R254	15K ohms, 10%, ½W, carbon	"
R255	10 ohms, 10%, ½W, A.B.	30 MC I.F. Amplifier, T2
R256	47K ohms, 10%, ½W, A.B.	"
R257	5 ohms, 5%, 10W, Truohm	Power Supply, BA
R258	20 ohms, 5%, 10W, Truohm	"
R259	50 ohms, 5%, 10W, Truohm	"
R260	75 ohms, 5%, 10W, Truohm	"
R261	125 ohms, 5%, 10W, Truohm	"
R262	200 ohms,5%, 10W, Truohm	"
R263	225 ohms, 5%, 10W, Truohm	"
R264	250 ohms, 5%, 10W, Truohm	"
R265	300 ohms, 5%, 10W, Truohm	"
R266	54 ohms, 5%, 10W, Truohm	"
R601	47 ohms, 10%, ½W, carbon	R.F. Tuner, T3
R602	1K ohms, 10%, ½W, carbon	"
R603	10K ohms, 10%, ½W, carbon	"
R604	2.2K ohms, 10%, 2W, carbon	"
R605	47 ohms, 10%, ½W, carbon	"
R606	1K ohms, 10%, ½W, carbon	"
R607	10K ohms, 10%, ½W, carbon	"
R609	10K ohms, 10%, 2W, carbon	"
R610	100 ohms, 10%, ½W, carbon	42 MC Cascode, T3
R611	4.7K ohms, 10%, ½W, carbon	"
R612	270 ohms, 10%, ½W, carbon	"
R613	150 ohms, 10%, ½W, carbon	"
R620	2.7K ohms, 10%, ½W, carbon	"
R621	150 ohms, 10%, ½W, carbon	"
R623	47K ohms, 10%, ½W, carbon	42 MC I.F. Amplifier, T3
R624	10 ohms, 10%, ½W, carbon	"
R625	220 ohms, 10%, ½W, carbon	"
R628	2.7K ohms, 10%, ½W, carbon	"
R629	100K ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R630	150 ohms, 10%, ½W, carbon	42 MC I.F. Amplifier, T3
R631	220 ohms, 10%, ½W, carbon	"
R633	15K ohms, 10%, ½W, carbon	"
R634	2.7K ohms, 10%, ½W, carbon	"
R635	100K ohms, 10%, ½W, carbon	"
R636	47K ohms, 10%, ½W, carbon	"
R637	220 ohms, 10%, ½W, carbon	"
R638	150 ohms, 10%, ½W, carbon	"
R639	150 ohms, 10%, ½W, carbon	"
R640	15K ohms, 10%, ½W, carbon	"
R641	2.7K ohms, 10%, ½W, carbon	"
R642	150 ohms, 10%, ½W, carbon	"
R643	470 ohms, 10%, ½W, carbon	"
R644	47 ohms, 10%, ½W, carbon	"
R645	150 ohms, 10%, ½W, carbon	"
R646	47 ohms, 10%, ½W, carbon	"
R647	150 ohms, 10%, ½W, carbon	"
R648	220 ohms, 10%, ½W, carbon	"
R649	150 ohms, 10%, ½W, carbon	"

X. RELAYS

Ref. Symbol	Description	Part of
RE1	DPDT relay, 8800 ohm coil	Impulse Generator P.R.R., BA
RE2	Voltage Regulator	Power Supply, BA

XI. FUSES

Ref. Symbol	Description	Part of
RG1	1.6A "Slo-Blo" type 3AG	Power Supply, BA
RG2	15A type 3AG for 24 Volt	Inverter, MO
RG3	15A type 3AG for 24 volt	"
RG2	20A MDL for 12 Volt	"
RG3	20A MDL for 12 Volt	"

XII. SWITCHES

Ref. Symbol	Description	Part of
S1	Wafer switch, 4 DPT - band change	R.F. Tuner, T1
S2	Wafer switch, multiple-function	VTVM Circuit, BA
S3	Wafer switch, meter multiplier	"
S4	Toggle switch OFF-momentary ON ST42C	"
S5	Wafer switch, DP3T - P.R.R.	Impulse Gen. P.R.R., BA
S6	Wafer switch 3P3T	Imp.Gen.-Sine Wave Osc., BA
S7	Toggle switch, DPDT ST 52 N	Meter Circuit, BA
S8	Toggle switch, SPST ST 42 A	Power Supply, BA
S9	Toggle switch, DPST ST 52 K	Inverter, MO
S601	Wafer switch, 3PDT - band change	R.F. Tuner, T3

XIII. TRANSFORMERS

Ref. Symbol	Description	Part of
T1	Line transformer	30 MC I.F. Amplifier, T2
T2	I.F. transformer	"
T3	I.F. transformer	"
T5	Line transformer	R.F. Tuner, T1
T6	Line transformer	"
T7	Line transformer	10.7 MC I.F. Amplifier, T1
T8	I.F. transformer	"
T9	I.F. transformer	"
T10	Audio output transformer	Audio Amplifier, BA
T11	Power transformer	Power Supply, BA
T601	Input transformer	42 MC Cascode, T3
T602	Output transformer	"
T603	Line transformer	42 MC I.F. Amplifier, T3
T604	I.F. transformer	"
T605	I.F. transformer	"
T606	I.F. transformer	"
T607	Output transformer	"

XIV. TUBES

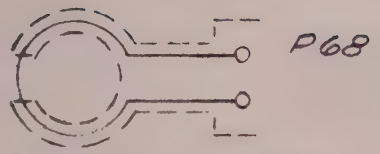
Ref. Symbol	Description	Part of
V1	5876	R.F. Tuner, T2
V2	6F4	"
V3	6CB6	30 MC I.F. Amplifier, T2
V4	6BJ6	"
V5	6BJ6	"
V6	6BJ6	"
V7	6BJ6	"
V8	6AK5	R.F. Tuner, T1
V9	6AK5	"
V10	12AT7	"
V11	6AK5	"
V12	6AK5	"
V13	6U8	"
V14	6AK5	10.7 MC I.F. Amplifier, T1
V15	6BJ6	"
V16	6BJ6	"
V17	6BJ6	"

XIV. TUBES continued

Ref. Symbol	Description	Part of
V18	6AL5	Meter Detector, BA
V19	6AB4	Audio Detector, BA
V20	12AU7	Audio Amplifier, BA
V21	12AT7	VTVM, BA
V22	12AT7	Sine Wave Oscillator, BA
V23	12AU7	Impulse Generator P.R.R., BA
V24	12AU7	"
V25	12AU7	"
V26	6X4	Power Supply, BA
V27	6X4	"
V28	6X4	"
V29	6X4	"
V30	6X4	"
V31	0A2	"
V601	5876	R.F. Tuner, T3
V602	6F4	"
V603	5876	"
V604	6T4	"
V605	6BQ7A	42 MC Cascode, T3
V606	6AK5	42 MC I.F. Amplifier, T3
V607	6AK5	"
V608	6AK5	"
V609	6AK5	"
V610	6BJ6	"

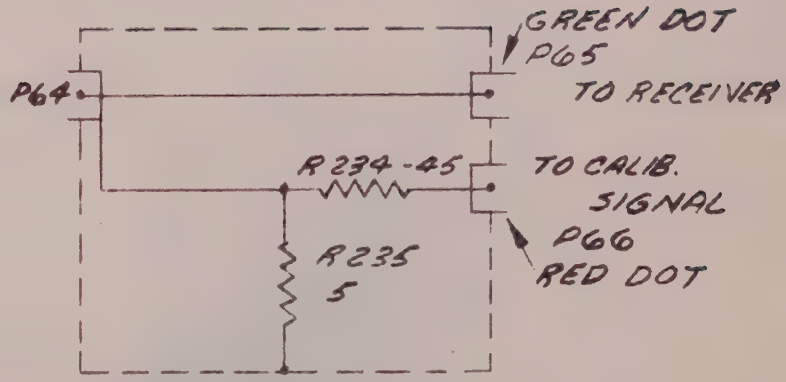
XV. CRYSTALS

Ref. Symbol	Description	Part of
X1	1N21B	R.F. Tuner, T2
X2	1N34A	VTVM, BA
X3	1N34A	Test Harness, AH
X601	1N21B	R. F. Tuner, T3
X602	1N21B	"

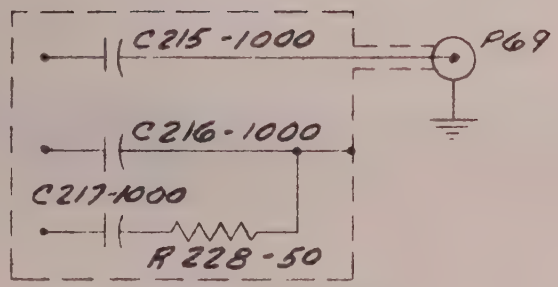


MAGNETIC FIELD PROBE

ELECTRIC FIELD PROBE



INJECTION BLOCK



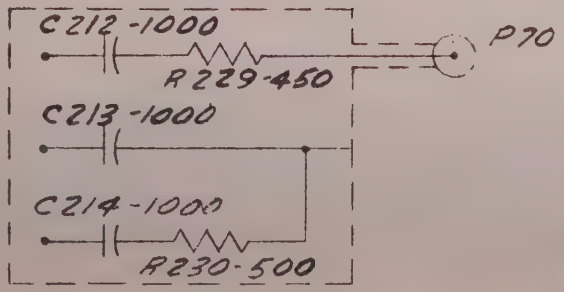
LINE PROBE - 50 Ω

DIPOLE ANTENNA

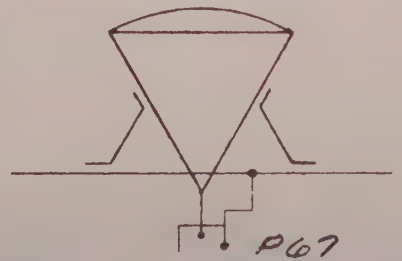
30 FT. CABLES

TO SIGNAL INPUT (P45)

TO IMPUSE GEN. (P32)



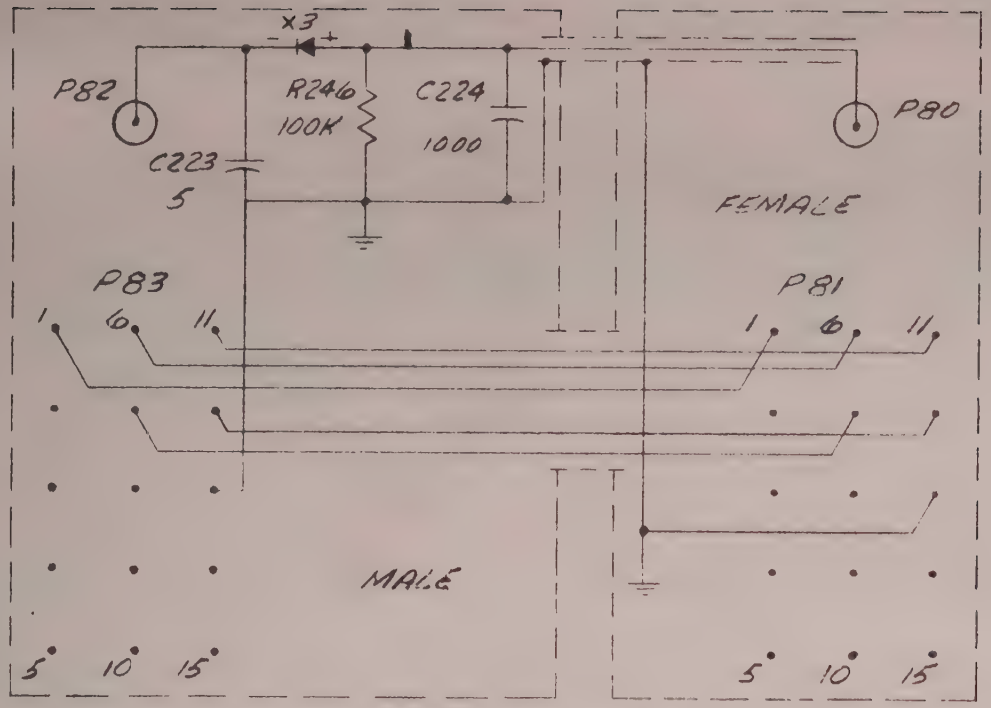
LINE PROBE - 500 Ω



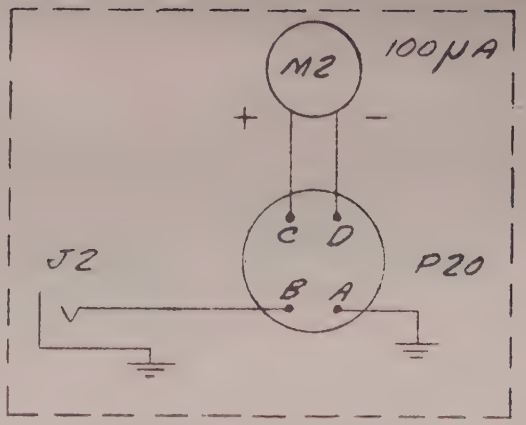
BROAD BAND ANTENNA.

ACCESSORIES "A"

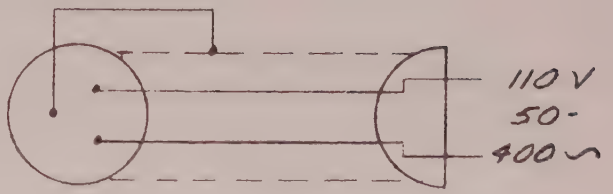
FIG. 25



TEST HARNESS

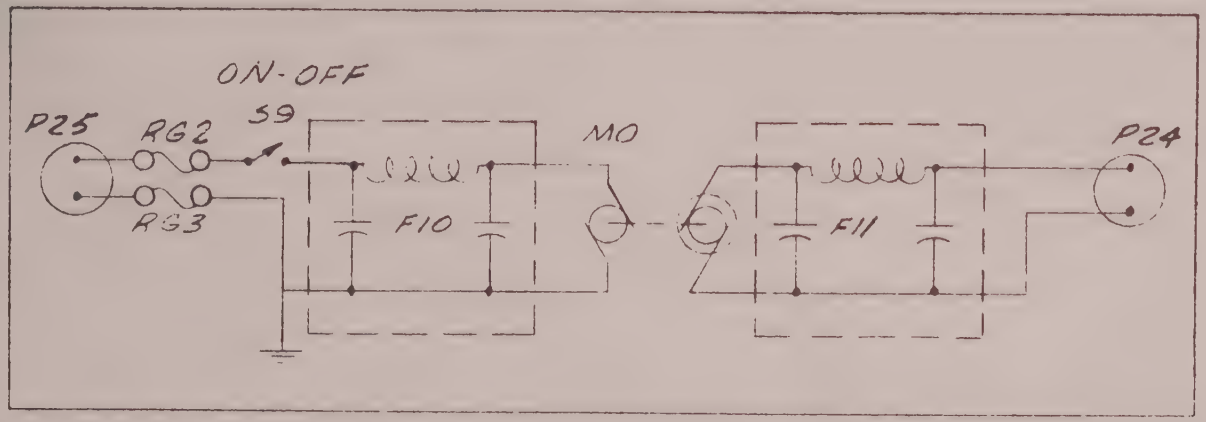


EXTERNAL METER



A.C. POWER CABLE

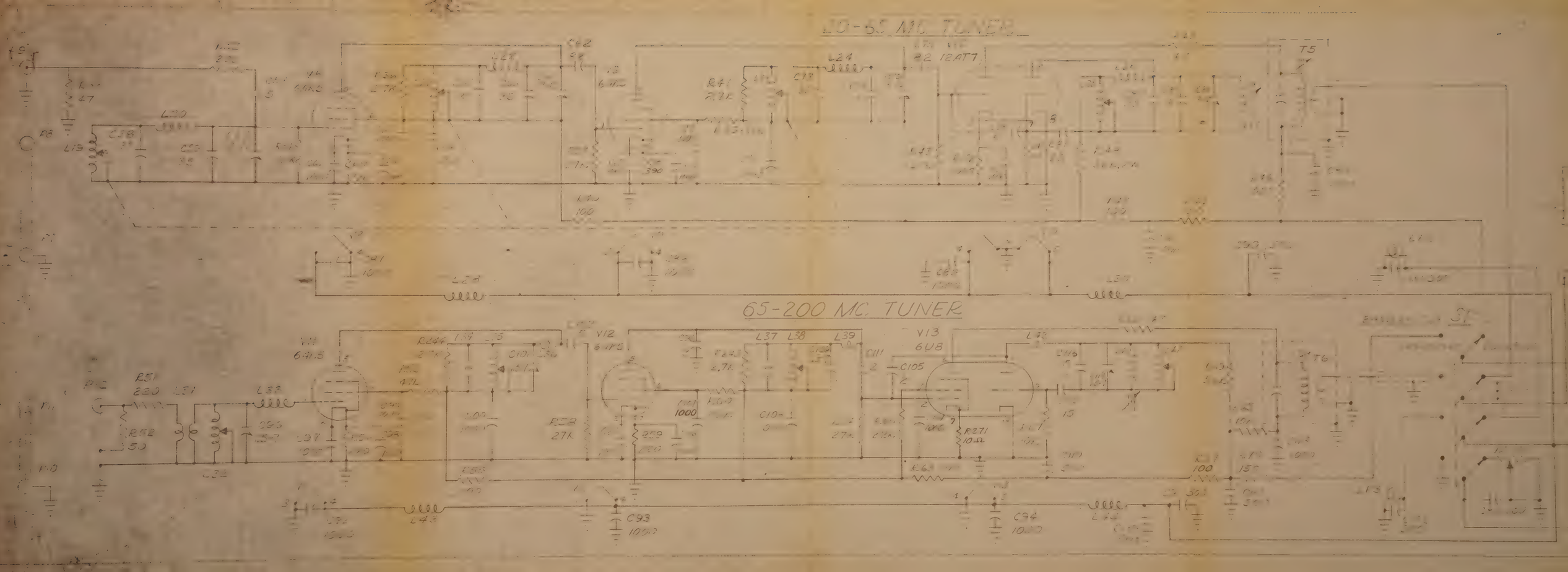
D.C. POWER CABLE



INVERTER

ACCESSORIES "B"

FIG. 26


10-65 MC. TUNER
65-200 MC. TUNER
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10.7 MC I.F. AMPLIFIER

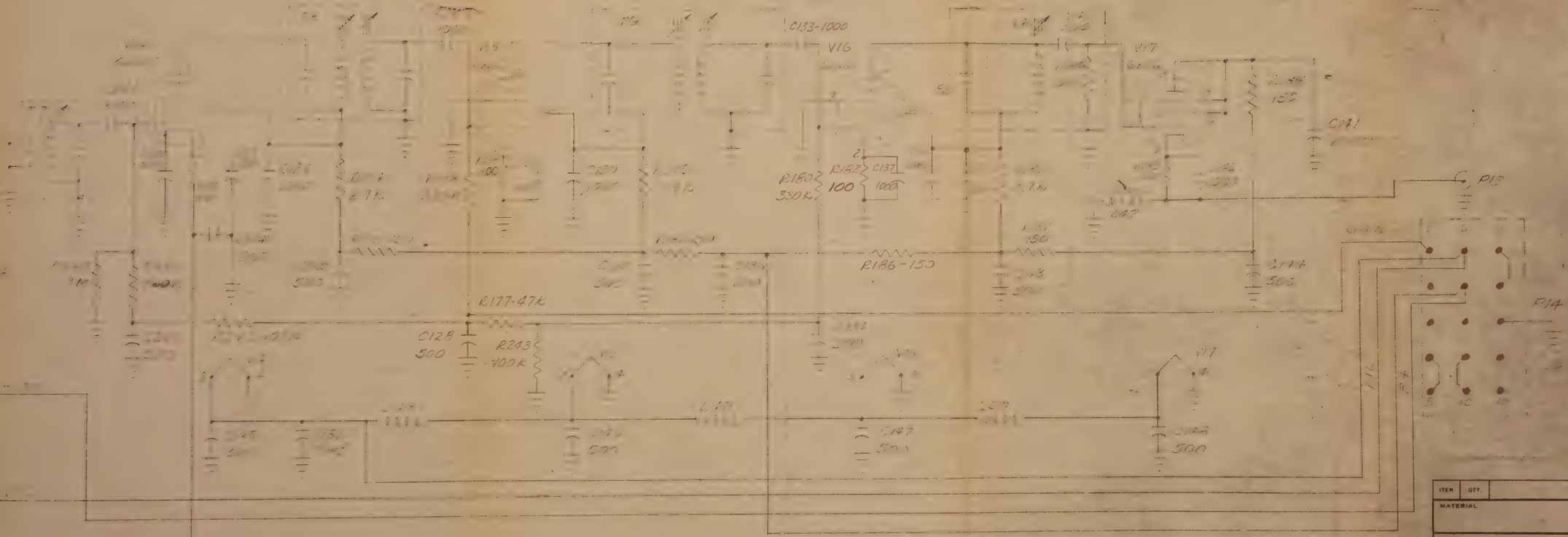
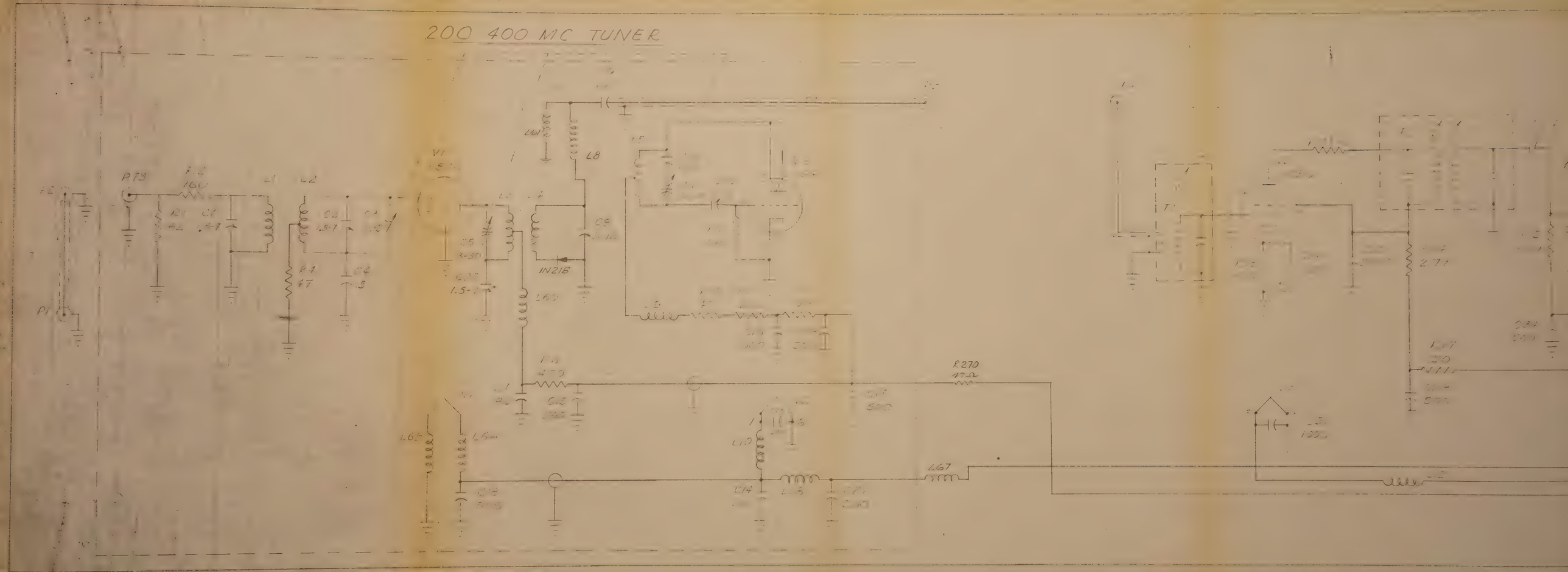
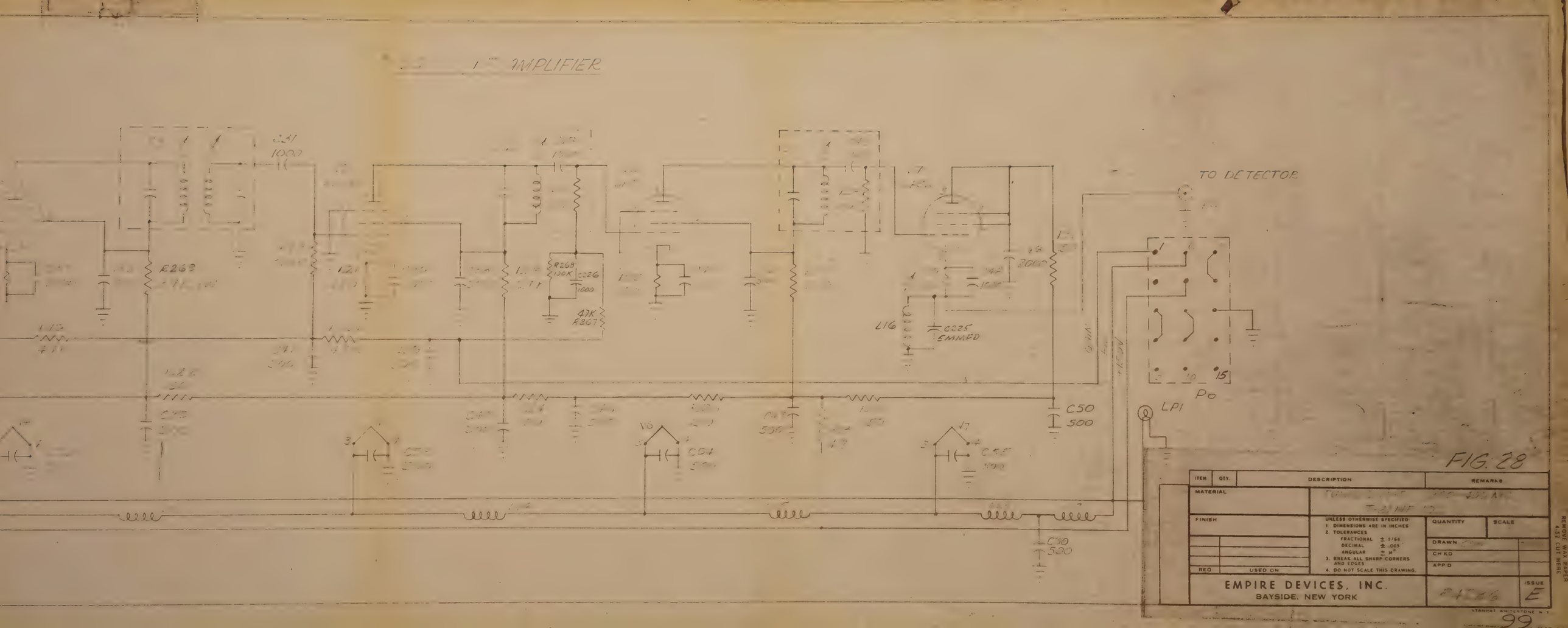


FIG. 27

ITEM	QTY.	DESCRIPTION	REMARKS
MATERIAL		TYPICAL I.F. 10.7 MC	
FINISH		UNLESS OTHERWISE SPECIFIED 1. DIMENSIONS ARE IN INCHES 2. TOLERANCES FRACTIONAL ± 1/64 DECIMAL ± .005 ANGULAR ± 1/2° 3. BREAK ALL SHARP CORNERS AND EDGES 4. DO NOT SCALE THIS DRAWING.	QUANTITY / SCALE
REQ	USED ON		DRAWN CH'KD APP'D
EMPIRE DEVICES, INC. BAYSIDE, NEW YORK			ISSUE E

200 400 MC TUNER




IF AMPLIFIER
C31
1000
R269
C32G
600
47K
R267
L16
C225
5MMFD
TO DETECTOR
P6
LP1
C50
500
C30
500
C54
C55
FIG. 28
ITEM
QTY.
DESCRIPTION
REMARKS
MATERIAL
FINISH
UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS ARE IN INCHES
2. TOLERANCES
FRACTIONAL ± 1/64
DECIMAL ± .005
ANGULAR ± 0°
3. BREAK ALL SHARP CORNERS AND EDGES
4. DO NOT SCALE THIS DRAWING
QUANTITY
SCALE
DRAWN
CH'KD
APP'D
REQ
USED ON
EMPIRE DEVICES, INC.
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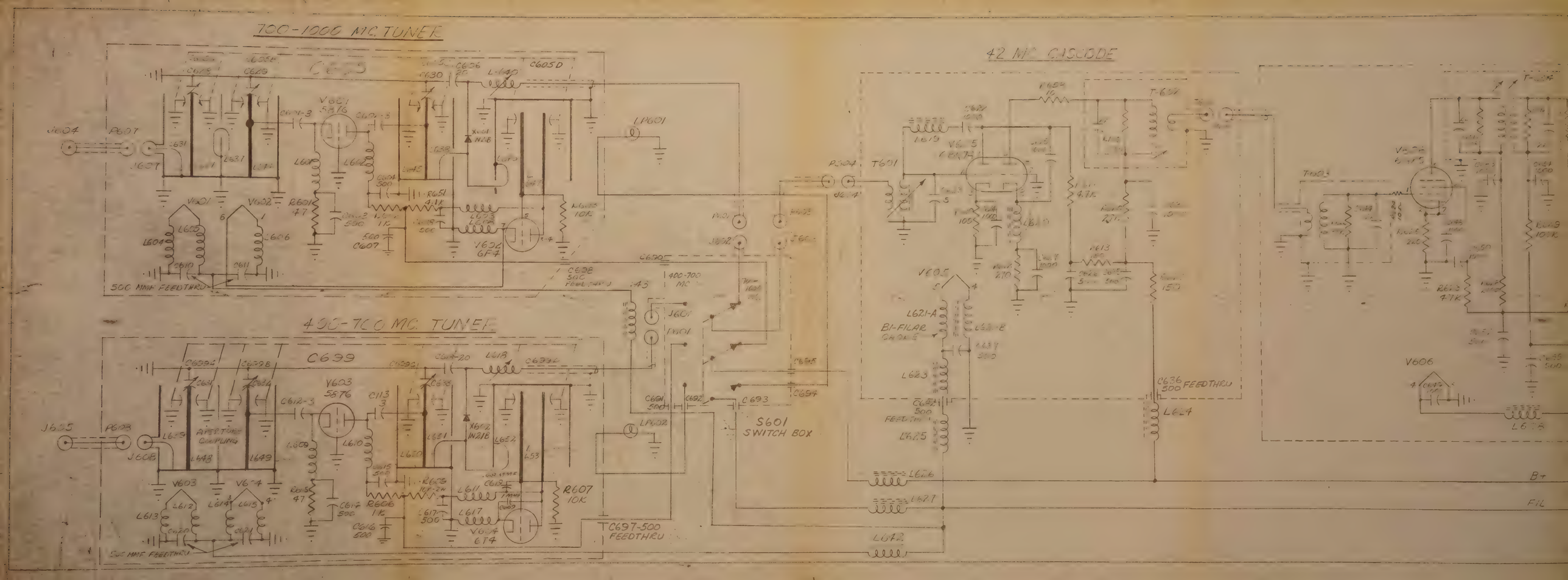
700-1000 MC TUNER
C605
C605A
C605B
C605C
C605D
C628
C630
L640
V601
5876
J604
P607
J607
L631
L632
L633
L634
L635
L636
L637
V601
V602
R631
47
L604
L605
L606
C610
C611
500 MMF FEEDTHRU
C601-3
C602-3
C603-3
C604
500
R651
4.1K
C605
1K
C606
500
C607
500
V602
6F4
C608
500
R652
10K
X601
1N21B
LP601
C638
500
FEEDTHRU
400-700 MC
J603
J602
J601
J604
P601
P602
P603
C690
C691
500
C692
C693
C694
S601
SWITCH BOX
LP602
400-700 MC TUNER
C699
C699A
C699B
C699C
C699D
C699E
C699F
C699G
C699H
C699J
C699K
C699L
C699M
C699N
C699P
C699Q
C699R
C699S
C699T
C699U
C699V
C699W
C699X
C699Y
C699Z
L618
L619
L620
L621
L622
L623
L624
L625
L626
L627
L628
L629
L630
L641
L642
L643
L644
L645
L646
L647
L648
L649
L650
L651
L652
L653
V603
5876
V604
6T4
C612-3
C613
3
C614
C615
C616
500
C617
500
R603
47
R604
1K
R605
1K
R606
1K
R607
10K
C697-500
FEEDTHRU
500 MMF FEEDTHRU
ANTENNA COUPLING
42 MC CASCODE
T601
T602
T603
T604
T605
V605
6AK5
V606
6AK5
R654
10
R655
4.7K
R656
100
R657
10K
R658
4.7K
R659
270
R660
1000
R661
270
R662
150
R663
220
R664
220
R665
4.7K
R666
100K
C650
C651
C652
C653
C654
C655
C656
C657
C658
C659
C660
C661
C662
C663
C664
C665
C666
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C669
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C681
C682
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C684
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C695
C696
L671
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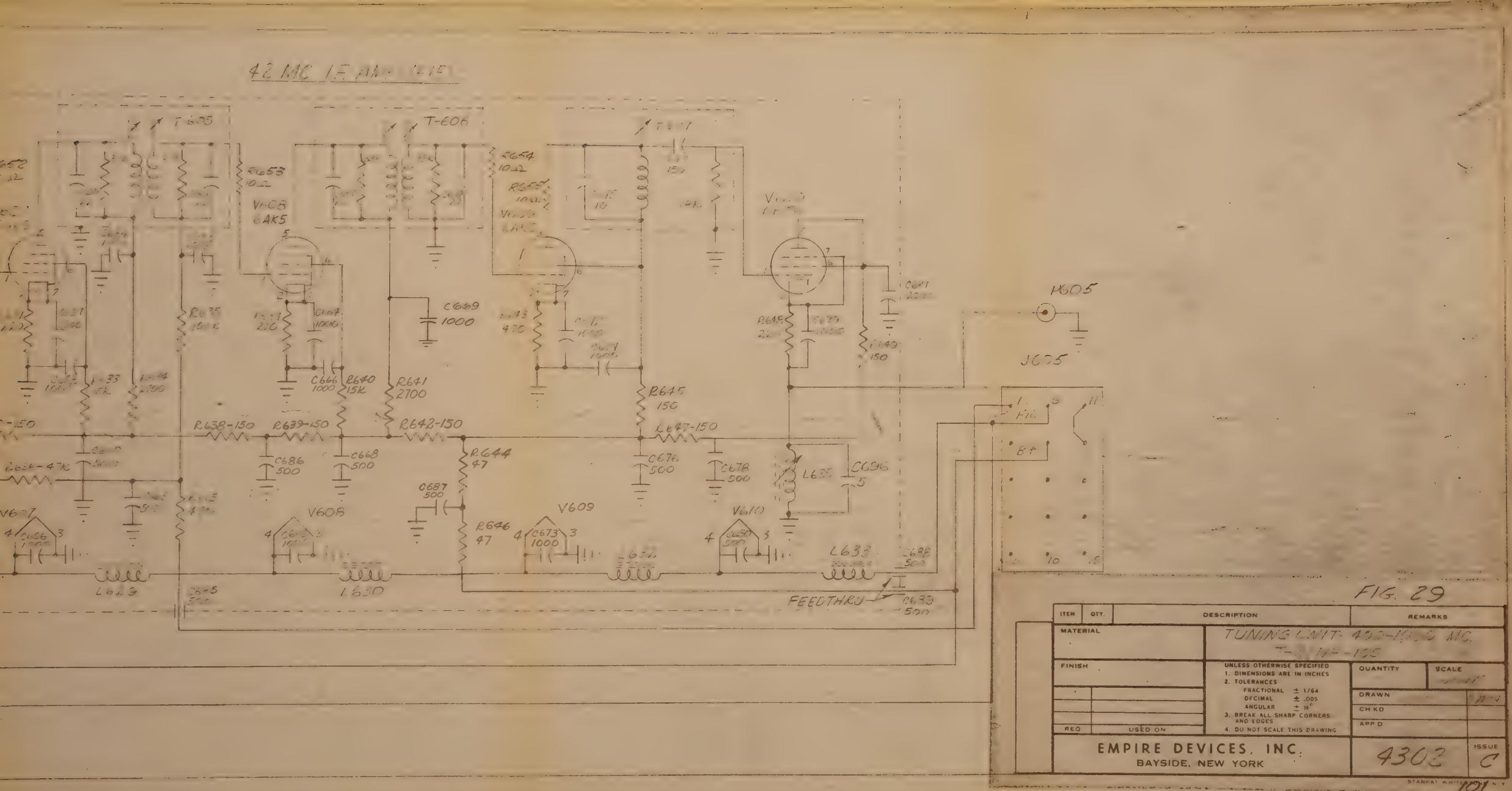
L707
L708
L709
L710


42 MC I.F. AMP. UNIT
T-605
T-606
T-607
R653 10Ω
R654 10Ω
R655 10Ω
V606 6AK5
V607
V608
V609
V610
C669 1000
C666 1000
R640 15K
R641 2700
R642-150
R638-150
R639-150
R644 47
R645 150
R647-150
R646 47
C686 500
C668 500
C687 500
C676 500
C678 500
L635
C636 5
L633
L632
L630
C688 500
C635 500
FEEDTHRU
C639 500
R649 150
J605
P605
B+
FIG. 29
ITEM
QTY.
DESCRIPTION
REMARKS
MATERIAL
TUNING UNIT 420-1000 MC.
T-607-125
FINISH
UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS ARE IN INCHES
2. TOLERANCES
FRACTIONAL ± 1/64
DECIMAL ± .005
ANGULAR ± ½°
3. BREAK ALL SHARP CORNERS AND EDGES
4. DO NOT SCALE THIS DRAWING
QUANTITY
SCALE
DRAWN
CH'KD
APP'D
REQ
USED ON
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REMOVE WAX PAPER
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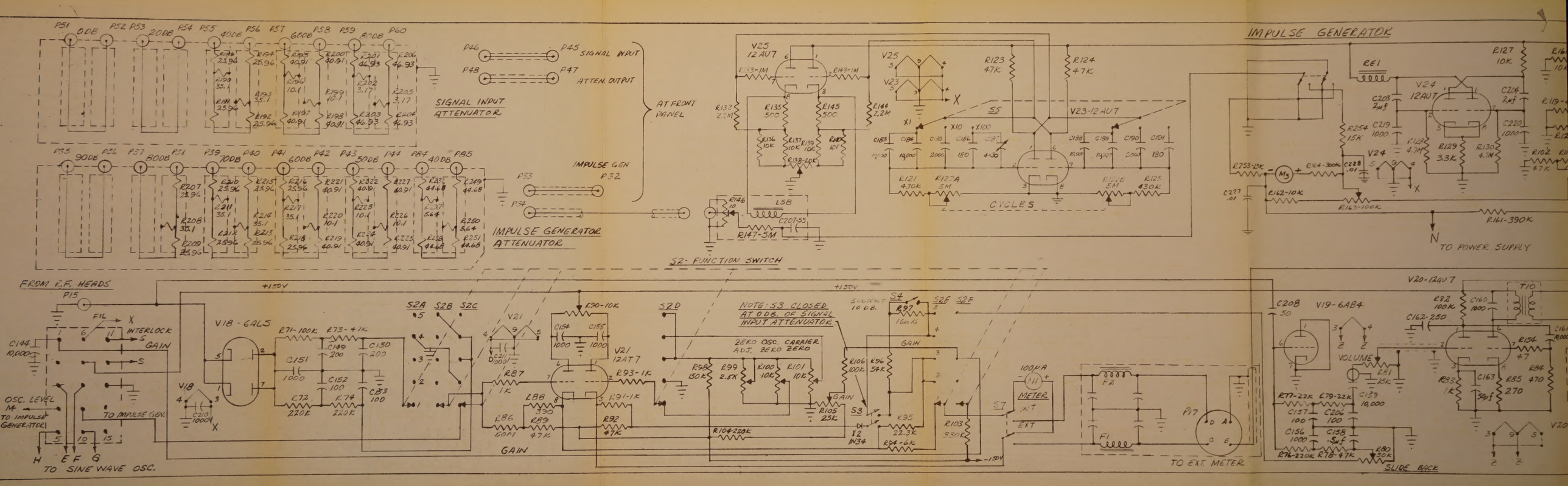
101


P51 0DB P52 P53 20DB P54 P55 40DB P56 P57 60DB P58 P59 80DB P60
P35 90DB P36 P37 80DB P38 P39 70DB P40 P41 60DB P42 P43 50DB P44 P84 40DB P85
SIGNAL INPUT ATTENUATOR
IMPULSE GENERATOR ATTENUATOR
P46 P45 SIGNAL INPUT
P48 P47 ATTEN. OUTPUT
P33 P32 IMPULSE GEN
P34
AT FRONT PANEL
S2- FUNCTION SWITCH
V25 12AU7
V23-12AU7
CYCLES
IMPULSE GENERATOR
RE1
V24 12AU7
TO POWER SUPPLY
FROM R.F. HEADS
P15
V18 - 6AL5
+150V
INTERLOCK
GAIN
OSC. LEVEL
TO IMPULSE GEN.
TO SINE WAVE OSC.
S2A S2B S2C S2D S2E S2F
NOTE: S3 CLOSED AT 0DB OF SIGNAL INPUT ATTENUATOR
ZERO OSC. CARRIER ADJ. ZERO ZERO
V21 12AT7
V19 - 6AB4
VOLUME
METER
INT
EXT
TO EXT. METER
SLIDE BACK
V20 - 12AU7
T10
-150V

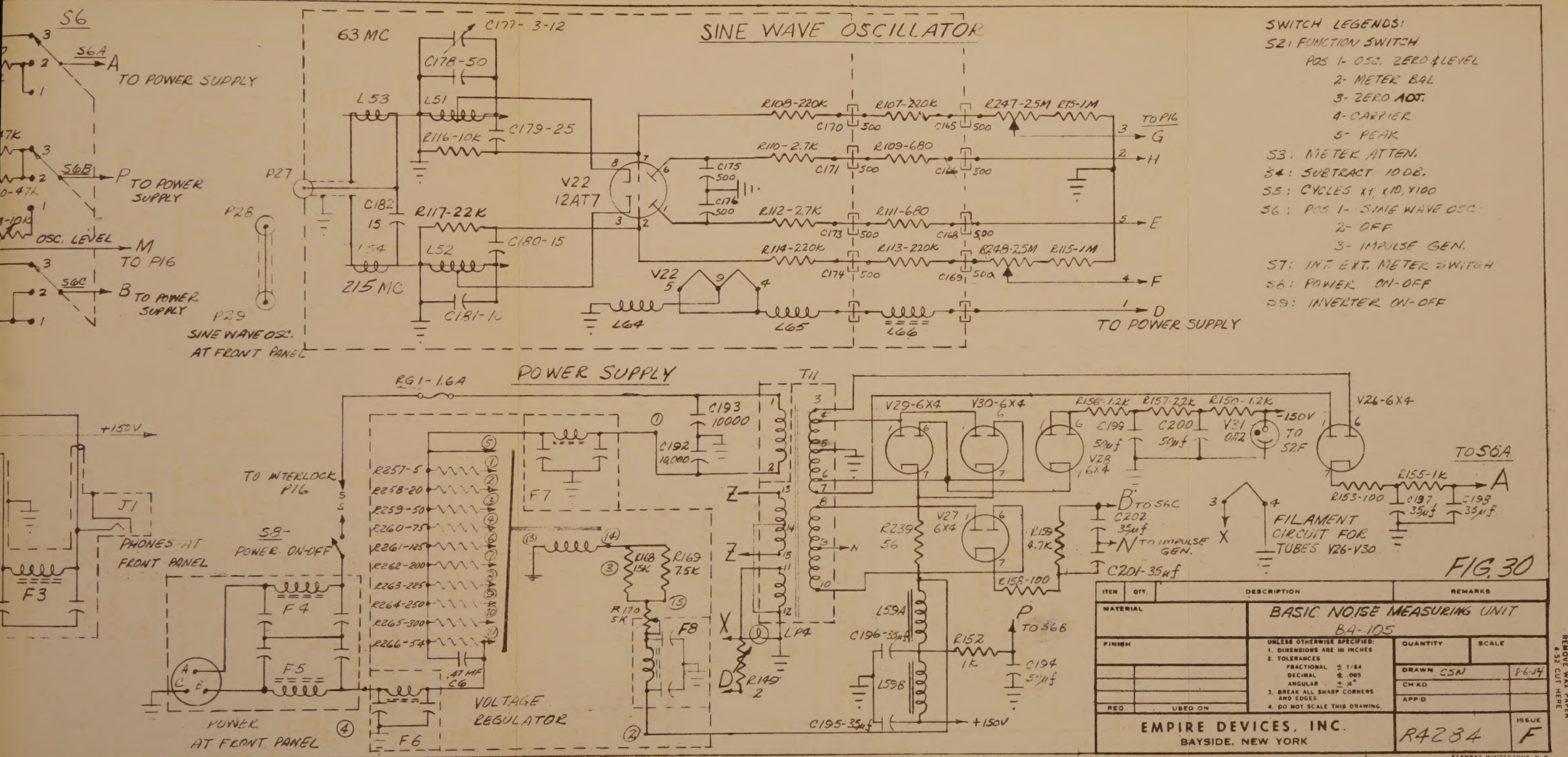


FIG. 30

ITEM	QTY.	DESCRIPTION	REMARKS
MATERIAL		BASIC NOISE MEASURING UNIT BA-105	
FINISH		UNLESS OTHERWISE SPECIFIED: 1. DIMENSIONS ARE IN INCHES 2. TOLERANCES FRACTIONAL ± 1/64, DECIMAL ± .005, ANGULAR ± ½° 3. BREAK ALL SHARP CORNERS AND EDGES 4. DO NOT SCALE THIS DRAWING.	QUANTITY / SCALE
REQ.	USED ON		DRAWN CSN 8-6-54
			CH'KD
			APP'D
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